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A SMALL SEWAGE DISPOSAL PLANT FOR A HIGH SCHOOL

Gustave J. Requardt, '09

The text books and engineering magazines have had much to say on the subject of big sewage disposal plants. The young engineer called upon to design a small system will find but very little information on the subject, and must rely to a great extent upon his own judgment. The plant herewith described perhaps will be of interest on this account.

In 1916 Norton Bird and Whitman were asked to design a layout to take care of the sewage from a high school in Baltimore County. About 500 pupils used the building during the day. No large stream was available into which sewage could be discharged, and the character of the surrounding district required that the sewage be well treated.

A plot of ground close to the school was determined upon for a site, and the plant designed consisted of a concrete two-story tank, siphon chamber, sand bed and outlet, and a sludge bed.

The pupils used the school building every day from 9 o'clock until 3. We estimated that there was a water consumption of 12 gallons per person per day, and because of the very short length of sewer necessary, we did not add to this figure for infiltration.

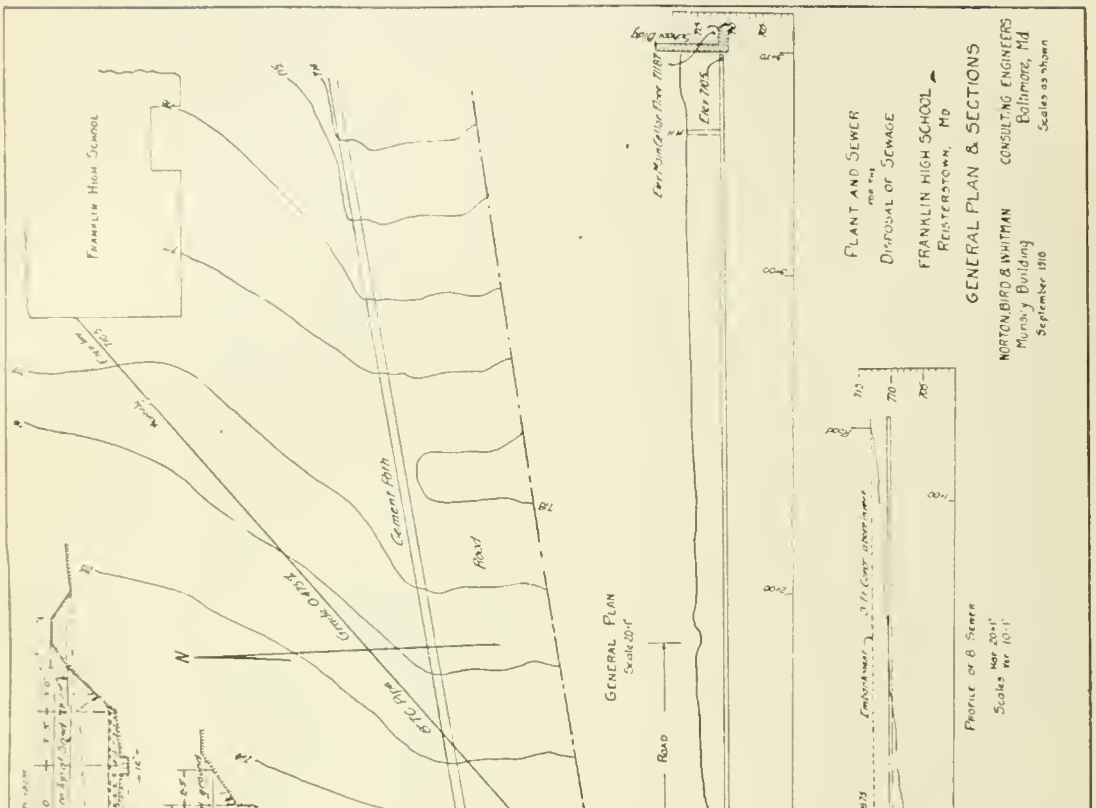
The plant was designed as follows:

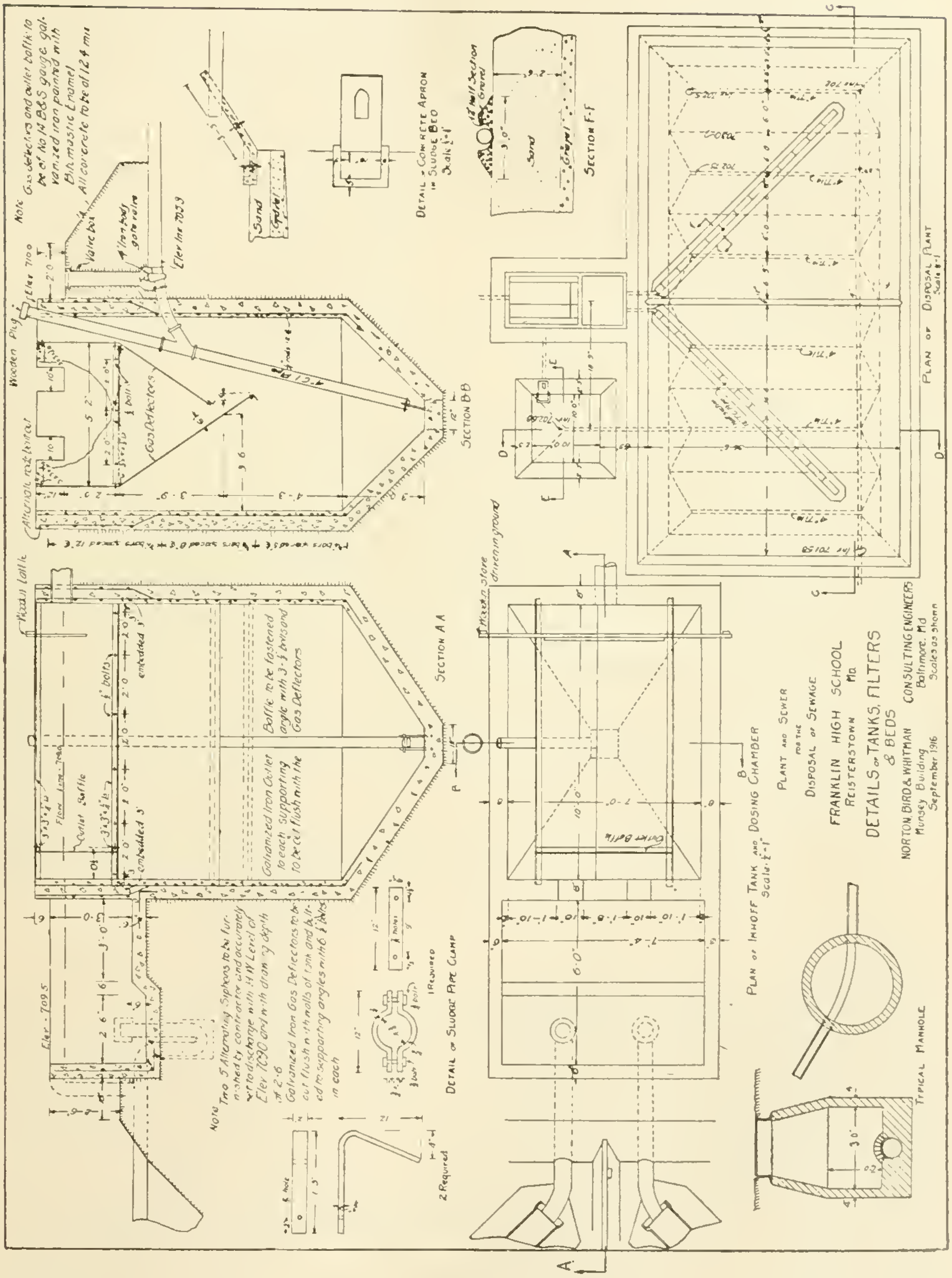
SEDIMENTATION: One and one-half hours minimum detention, or 200 cubic feet volume.

SLUDGE CAPACITY: One-half cubic foot per person for six months, or 250 cubic feet volume.

DOSING CHAMBER: Beds to be alternately dosed one inch in depth for entire area, or 109 cubic feet volume.

SAND BED: 100,000 gallons per acre per day, or 3,620 square feet of sand area.


Plant and Sewer
for the
Disposal of Sewage
Franklin High School
Reisterstown, Md
General Plan & Sections
Norton, Bird & Whitman
Munsey Building
September 1910
Consulting Engineers
Baltimore, Md
Scales as shown
Franklin High School
Old School Building
General Plan
Scale 20-1'
Road
Cement Path
Brick Walls
N
Imhoff Tank
Dosing Chamber
Sludge Bed
Filters
Sand
Profile of 8" Sewer
Scales Hor 20=1' Ver 10=1'
Sect C-C through Sand Filters
Sect D-D through Sand Filters and Sludge Bed
Sect E-E through Sludge Bed
Scale 1/8"=1'
Orig'nl ground
Sand


Plan of Imhoff Tank and Dosing Chamber Scale 1/4"=1'
Plant and Sewer for the Disposal of Sewage
FRANKLIN HIGH SCHOOL
Reisterstown Md
DETAILS of TANKS, FILTERS & BEDS
NORTON, BIRD & WHITMAN CONSULTING ENGINEERS
Munsey Building Baltimore, Md
September 1916 Scales as shown
Section A A
Section B B
Section F-F
Plan of Disposal Plant Scale 1/8"=1'
Typical Manhole
Detail of Sludge Pipe Clamp
Detail of Concrete Apron in Sludge Bed Scale 1/2"=1'
Note Gas deflectors and outlet baffle to be of No 14 B.&S. gauge galvanized iron painted with Bitumastic Enamel. All concrete to be of 1:2:4 mix
Note Two 5" Alternating Siphons to be furnished by contractor and accurately set to discharge with H.W. Level of Elev 709.0 and with draw off depth of 2'-6"
Galvanized Iron Gas Deflectors to be cut flush with walls of tank and bolted to supporting angles with 3 1/2" bolts in each
Galvanized Iron Outlet to each supporting to be cut flush with the
Baffle to be fastened at angle with 3-1/2" bolts and Gas Deflectors
Gas Deflectors
Outlet Baffle
Wooden Plug
Valve box
Iron body gate valve
Sand
Gravel
Broken stone driven in ground
Elev 709.5
2 Required
1 Required

SLUDGE BED: One square foot of area per five persons, or 100 square feet.

Plans called for 342 feet of 8″ terra cotta sewer, Imhoff tank 10 feet long by 7 feet wide by 14 feet deep, with 8″ concrete walls reinforced against earth pressure, the upper and lower stories divided by galvanized sheet iron, No. 14 B. & S. gauge, reinforced by 3″ angles, and the whole coated with "Bitumastic Enamel." In the dosing chamber were placed two 5″ alternating Miller siphons to dose the two sand beds. The sand beds were 36 feet square each with a minimum of 30″ of sand and 6″ of gravel. The sludge bed was made 10 feet square with 9″ of sand and 6″ of gravel.

The excavation for the sludge tank was made without the use of sheeting and the earth was used as a back form. The galvanized sheet iron was built up by the foundry to proper dimensions, and after the concrete had hardened, the whole affair was lowered into the tank and the projecting ends of angle reinforcing cemented into the walls. The edges of the sheet iron fitted neatly up against the concrete walls and were made leak-proof by strips of wood on both sides of the iron. The sheet iron and angles were given a liberal coat of "Bitumastic Enamel" paint about 1/8″ thick. The makers claim for this material long life, resistance to heat and cold and thorough protection to the iron.

The requirement for sand in the beds was that it have an effective size of from .30 to .45 millimeters, with a uniformity coefficient of 2½. The gravel for the beds was specified to pass a 1″ screen and to be retained on a ¼″ screen.

The contract was awarded to Ensey & Gildea, of Baltimore, General Contractors. Gildea, by the way, is Ray Y. Gildea, Cornell C. E., '12.

The prices bid for the principal items were as follows:

Excavation	$ .75	cu. yd.
Furnishing and laying 8″ T. C. pipe	.40	lin. ft.
Furnishing and laying 4″ under-drain pipe	.15	ft.
Concrete in Imhoff Tank and Dosing Chamber	10.00	cu. yd.
Sand in place	2.00	cu. yd.
Sheet iron in Imhoff Tank in place	200.00	lump sum
Two 5″ siphons in place	100.00	" "
Cast iron sludge pipe in place	50.00	" "

The cost of the various items on the whole work was as follows:

Sewer	$ 262.68
Imhoff Tank	455.06
Dosing Chamber	208.45
Sand Bed	839.34
Sludge Bed	31.57
	$1,797.10

The above amount, divided by 500 persons, gives a figure of $3.59 per person for the cost of disposing of the sewage, which is very low.

Several months after this plant was built, sewage was first allowed to enter it, when it was found that the Imhoff tank would not fill up. It seemed that after a certain head of water accumulated in the tank the leakage through the walls equaled the amount of inflow and the water level would remain fixed about 2 feet below the weir outlets. While we felt that this leakage would be taken up in a few weeks by the sediment in the sewage, the school commissioners desired that the tank be made water-proof and we unwatered it and attempted to plaster the horizontal joints between the floor and the side walls with a coating of pitch. Ray Gildea and myself being rather thin lowered ourselves through a side gas vent and smeared a goodly coating of tar completely over the bottom.

On refilling with water, the tank still did not seem to be leak-proof, and for a week the water level did not rise to the outlet weirs In about ten days the leaks became filled with sediment and water started flowing through the siphons and on to the sand beds. Since that time no trouble at all has been experienced as far as leaks are concerned.

The whole plant for the last three years has been working exceedingly well. The janitor of the school building, after being educated to rake up leaves off the sand bed, to provide mounds of sand during the winter time to prevent the whole surface on the bed from freezing, to remove sludge periodically from the Imhoff tank, has transformed himself into an expert operator. The sand bed effluent is clear and no complaint has been heard from the farmer who owns the land through which the effluent flows. No odors are noticeable from the plant.

I hope for the time when the spirit of engineering as found in practice will form a more definite part of engineering education. This, I think, must come through the professor keeping in close practical touch with the engineering world. There are various ways in which this may be accomplished, but I know of none better than by each professor doing a reasonable amount of practical work for commercial purposes. Under some conditions, this may be consistently accomplished during a portion of his time, but I am inclined to think that eventually our professors will devote all their time to instruction while they teach and go periodically into the world, a few years at a time, for practice. Thus the professorial life would not be so exclusively educational, and our growing engineering institutions would be enabled to enlarge their faculties by the devotion to teaching of a portion of the time of men who are primarily engaged in commercial work.—Kerr.

THE DISINFECTION OF SEWAGE BY THE USE OF CHLORINE AND ITS COMPOUNDS

Chester G. Wigley, '07

The fact that disease producing organisms in sewage can be destroyed by comparatively small doses of chlorine gas or its compounds has been known in this country for more than ten years, but the application of the process and the installation of devices for this purpose has not progressed as rapidly as might be desired. At about the same time the disinfection of water-supplies by means of chlorine compounds, for the purpose of protecting the health of consumers was brought to the attention of the engineering profession, and has been extensively adopted in this country and in foreign countries; resulting in almost every instance in an improvement of the quality of the water-supply and a reduction in the number of cases of diseases which are usually transmitted by means of water.

It is equally important in many cases that the sewage from a municipality be sterilized before being discharged into a stream and that the disease producing organisms present in it be prevented from being widely disseminated, as they may be economically and satisfactorily removed at the source of supply or at the sewage outlet. In many sections of the United States the populations have increased to such an extent that the natural drainage areas of municipalities for their waste liquids must be into the watersheds utilized by other municipalities situated nearer the coast. The sewage from such municipalities should be disinfected. The practice of discharging undisinfected sewage into streams used as sources of water-supply, or for other uses where human beings come in contact with the water, is, to say the least, unneighborly and without sufficient justification for the continuance of the practice.

During the Conference of the International Joint Commission of the United States and Canada with reference to the pollution of the Great Lakes, it was clearly demonstrated by the replies of the sanitary engineers and experts called in that they were of the opinion that the sewage discharged into the Great Lakes should be disinfected at the sewer outlet.

In the State of New Jersey many municipalities have been required to sterilize the sewage because of the fact that the area in which shell fish are grown or where people bathe, or streams from which people derive water-supplies would otherwise be seriously and often disastrously polluted. The results of such disinfection have in general been very satisfactory, but depend primarily upon the person operating the plant, who must be conscientious and painstaking in the performance of his duties.

The purpose of this paper is to give the results obtained when disinfecting the sewage at one or two places in that State.

At the city of Millville, N. J. a sewage treatment plant had been constructed consisting of settling basins, an aerating basin, contact beds and tidal storage basin. Because of the increase in the flow of sewage and backing up of the tide into the contact beds the results obtained had seldom been satisfactory. The effluent from the plant was discharged into the Maurice River which is used about twelve miles below the city for the floating of shell fish. The poor quality of the effluent resulted in complaints being made to the State Department of Health by people operating the shell fisheries as they were threatened with loss of business because of the pollution of the floating areas. The city, because of a recent program of municipal improvements, had very nearly reached its bonded indebtedness limit and the municipal officials stated that it was impossible for them to extend the existing works, providing adequate capacity for proper treatment of the sewage in the existing type of plant. Some tests made by the State Department of Health of New Jersey had before this time demonstrated the possibility of obtaining a satisfactory effluent by the use of chlorine gas as a disinfecting agent. The results obtained during these tests are shown in the Table I, giving the amount of chlorine used in parts per million and the number of organisms present as indicated by the test for B. Coli, total count, and red colonies when incubated at 37° C.

It was therefore finally decided that the most economical and expeditious procedure was for the city of Millville to provide proper equipment for the sterilization of the sewage, with laboratory facilities and a qualified man in charge of the laboratory to make daily tests of the effluent. Before proceeding to give the results of this treatment it will be advantageous to give a brief survey of the conditions at the city relative to the sewage disposal works.

The city of Millville, N. J. had a population of over 13,000, the town being situated in the southern portion of New Jersey, and the surface of the ground being gently sloping towards the Maurice River. The grades of the sanitary sewer system are mostly low. The daily sewage flow from measurements made by means of a weir placed at the outlet of a settling basin averaged 1,300,000 gallons per day; the maximum rate of flow being 1,350,000 gallons per day. As the sewage from the city flows through a long trunk sewer before reaching the settling basins and as it is known that there is considerable leakage into the sewage system it is probable that these conditions account for the small variation between the average and maximum flows.

RESULTS OBTAINED WHEN DISINFECTING THE SEWAGE OF THE CITY OF MILLVILLE, N. J. WITH CHLORINE GAS

BACTERIA PER C. C. 37° C.

DATE	Cl. Parts per Million	B. COLI			AGAR PLATES		
		Raw	Treated	% Reduction	Raw	Treated	% Reduction
March 6, 1918	3.96	40,000	1,000	97.5	273,000	52,000	81.
" 7, 1918	3.96	8,000	400	95	510,000	117,00	97.7
" 8, 1918	4.4	4,000	400	90	350,000	13,000	96.2
" 9, 1918	4.65	20,000	600	97	415.000	10,400	97.5
" 19, 1918	4.83	4,000	200	95	86,000	2,800	96.7
" 20, 1918	5.45	6,000	400	93.3	578,000	5,400	99.1
" 21, 1918	5.1	6,000	800	87	810,000	16,000	98
" 22, 1918	5.58	6,000	400	93.3	650,000	10,875	98.4
" 23, 1918	5.58	800	80	90	842,500	3,735	99.6
" 25, 1918	5.58	20,000	200	99	450,000	5,635	98.8
" 26, 1918	5.7	6,000	80	98.7	410,000	2,700	99.3
" 27, 1918	6.03	8,000	60	99.2	420,000	7,525	98.2
" 28, 1918	5.7	10,000	100	99	450,000	3,500	99.2
" 29, 1918	6.03	6,000	80	87.7	416,000	5,100	98.8*
" 30, 1918	6.1	4,000	2,000	50.0	392,000	2,200	99.4*
April 9, 1918	6.03	4,000	4,000	0	351,250	8,200	97.7*
" 10, 1918	5.58				284,500	3,100	98.9
" 11, 1918	6.43	2,000	100	99.5	329,000	4,630	98.6
" 12, 1918	6.03	1,000	80	99.2	418,500	1,900	99.5
" 13, 1918	6.03	8,000	200	97.5	318,500	2,000	99.4
" 23, 1918	5.7	10,000	100	99	333,000	1,750	99.5
" 24, 1918	5.4	5,000	500	90	393,000	3,150	99.2
" 25, 1918	6.03	10,000	1,000	90	330,000	20,500	94.
" 26, 1918	6.03	5,000	100	98	281,000	12,025	96.
" 27, 1918	6.03	5,000	100	98	310,000	8,250	97.3
May 3, 1918	5.7	10,000	1,000	90	385,000	13,600	96.5
" 4, 1918	5.2	10,000	1,000	90	644,500	23,000	96.4
" 16, 1918	6.24	10,000	1,000	90	656,000	26,000	96.
" 17, 1918	6.09	10,000	660	93.4	665,000	17,100	97.4
" 18, 1918	6.31	10,000	100	99	390,000	23,200	94.
" 20, 1918	5.7	10,000	500	95	552,000	32,700	94.1
" 21, 1918	6.03	10,000	1,000	90	343,000	8,900	97.4
" 22, 1918	6.14	1,000	100	90	223,000	3,600	98.4
" 23, 1918	6.14	10,000	100	99	582,000	6,700	98.9
" 24, 1918	5.02	10,000	1,000	90	622,000	17,300	97.2
" 25, 1918	6.33	500	100	80	365,500	980	99.7
" 27, 1918	6.1	1,000	100	90	358,000	6,150	98.3
" 28, 1918	5.76	5,000	500	90	315,500	5,950	98.1
" 31, 1918	6.14	5,000	500	90	564,500	15,200	97.3
June 1, 1918	6.68	10,000	10	99.9	436,750	2,930	99.4
" 3, 1918	5.7	5,000	100	98	275,000	3,400	98.8
" 4, 1918	6.14	5,000	100	98	551,000	12,800	97.7
" 5, 1918	6.03	10,000	500	95	652,000	7,840	98.8
" 13, 1918	6.63	1,000	100	90	576,000	7,000	98.8
" 22, 1918	4.00	1,000	100	90	368,000	37,200	90.0
" 25, 1918	6.4	10,000	100	99	473,000	2,650	99.4
July 22, 1918	6.5	5,000	100	98	652,500	15,500	97.6
" 23, 1918	6.93	1,000	100	90	434,000	2,800	99.4
" 24, 1918	7.07	1,000	50	95	60,000	1,050	98.3
" 25, 1918	6.93	10,000	50	99.5	106,200	1,125	99.0
" 26, 1918	7.62	10,000	0	100	544,000	525	99.9
" 27, 1918	7.25	5,000	0	100	307,000	750	99.8
" 29, 1918	6.5	10,000	100	99	852,000	1,100	99.9
" 30, 1918	6.91	5,000	50	99	287,200	1,300	99.5
" 31, 1918	7.8	10,000	50	99.5	297,000	300	99.9
Aug. 1, 1918	7.25	5,000	100	98	550,000	1,900	99.7
" 3, 1918	6.91	1,000	100	90	322,000	1,100	99.7

*Faulty operation of apparatus.

TABLE I

Results Obtained When Disinfecting the Sewage of the City of Millville, N. J., with Chlorine Gas

Disinfection of the sewage of the City of Millville, N. J. with Varying Amounts of Chlorine Gas

Bacteria per C. C. 37°

8/3/16 to 8/5/16 TOWN	P. P. M. Cl. in eff.	Total	Red Colonies	B. Coli	Total	% Reduction	Red	% Reduction	B. Coli	% Reduction
Millville......	3.7	150,000	100,000	0.00001	1,000	99+	Less than 1000	99+	.001	99
"	3.7	400,000	150,000	0.00001	45,000	89	20,000	87	.001	99
"	3.7	300,000	220,000	0.000001	7,000	98	3,000	98+	.001	99.
"	4.2	210,000	100,000	0.00001	4,000	98	1,000	99	.01	99.9
"	4.2	180,000	110,000	0.00001	7,000	90	Less than 1000	99+	.01	99.9
"	5.8	40,000	40,000	0.0001	2,000	95	Less than 1000	98	.1	99.9
"	5.8	300,000	200,000	0.000001	Less than 1000	99.9	Less than 1000	99.9	.01	99.9
"	6.3	150,000	100,000	0.0001	1,000	99+	Less than 1000	99+	.1	99.9
"	6.3	200,000	130,000	0.0001	Less than 1000	99+	Less than 1000	99+	.1	99.9
"	6.3	220,000	170,000	0.00001	Less than 1000	99+	Less than 1000	99+	.1	99.9
"	7.1	290,000	80,000	0.00001	300	99.9	Less than 1000	99+	.01	99.9
"	7.1	370,000	190,000	0.00001	900	99.7	300	99.8	.1	99.9

TABLE II

In the remodeled plant the contact beds and tidal basins were practically abandoned being of very little value in treating the daily flow of sewage. The disinfecting apparatus was arranged so as to disinfect the settled sewage in the aerating chamber permitting about ten to fifteen minutes contact after the addition of the chlorine until it was discharged into the outlet. The apparatus used was the Manual Control, Direct Feed Chlorinator as manufactured by the Wallace and Tiernan Company.

The sedimentation tanks are four in number each compartment having the following dimensions along and to the water surface: Length 76′-6″; width 15′-6″; depth 6′-0″. The tanks contain baffles with the exception of shallow surface boards. The sewage enters each compartment through two pipes at the water elevation.

The results of the treatment given in Table II have been supplied to the writer by Newton C. Wade, City Engineer of Millville, and show that with few exceptions since the remodeling of the plant and the use of disinfecting agents the bacterial removal has been adequate for the protection of the shell fish for the months of March, April, May, June, July and part of August, 1918.

There are also given below the results obtained when disinfecting the sewage from Camp Merritt, New Jersey by means of liquid chlorine which results have been kindly supplied by Captain Paul Molitor.

BACTERIOLOGICAL EXAMINATIONS OF SAMPLES OF SEWAGE AND RIVER WATER FROM CAMP MERRITT DISPOSAL WORKS

LABORATORIES OF HACKENSACK WATER CO.

Date	Bact. per c. c.		48 Hour Count Gelatine at 20° c. c.		B. Coli Communic		In .001 c. c. inoculation	
	Camp Merritt Raw Sewage	Final Effluent	River Water 500′ Upstr'm from Effl. Outlet	River Water 500′ D'nstr'm from Effl. Outlet	Camp Merrtit Raw Sewage	Final Effluent	River Water 500′ Tpstr'm from Effl. Outlet	River Water 500′ D'nstr'm from Effl. Outlet
12–19–18			870,000	1,300,000	Present	Present	Present	Present
12–26–18	1,410,000	120,000	90,000	2 00,000	“	“	“	“
12–31–18	1,240,000	10,000	20,000	40,000	“	Absent	“	“
1– 2–19	880,000	40,000	100,000	84,000	“	Present	“	“
1– 7–19	1,000,000	313,000	9,000	129,500	“	“	Absent	“
1–21–19	970,000	20,000	170,000	40,000	“	“	Present	“
1–28–19	1,940,000	18,000	5,000	8,000	“	“	Absent	Absent
2– 4–19	1,860,000	1,000	1,400	3,500	“	Absent	Present	Present
2–11–19	2,640,000	7,000	20,000	48,500	“	Present	“	“
2–18–19	1,550,000	4,000	4,500	4,950	“	Absent	“	Absent
2–26–19	1,880,000	1,500	46,000	55,000	“	“	Absent	Present
3– 4–19	1,590,000	500	4,000	1,300	“	“	“	Absent
3–11–19	1,530,000	400	2,000	3,000	“	“	“	“
3–18–19	1,770,000	1,550	1,900	1,200	“	“	Present	“
3–25–19	1,960,000	850	2,350	2,400	“	“	Absent	“

River water samples taken from tide water below dams of Hackensack Water Co.
G. R. Spalding, Bacteriologist.

These results are interesting in showing a comparison between the B. Coli contained in the river water 500 feet above the sewer outlet and 500 feet below the sewer outlet.

In all cases where sewage sterilization plants are installed it is well to bear in mind that the amount of chlorine to be used can only be satisfactorily determined by actual tests made upon the sewage to be treated as the amount of chlorine required for sewages of different character varies through very wide limits.

A broad culture fits a man for any society. But if the end were simply selfish—his own increased enjoyment of life, or greater professional advancement—it might not be worth the seeking. But each man should pay back to society something that he takes from it, and his present duty is clear. In spite of ever increasing wealth and prosperity, in spite of great achievements in science and particularly engineering science, bringing increased comfort and luxury to every man, the ideals of society as a whole are disappointingly low. Power and wealth are sought for their own sakes; commercialism and rapid living rule the day. Nearly every one is caught in the tide and, in spite of better judgment, swept along with the current. It is the man of broad culture and high ideals who must lead the way to things better worth while, that the lives of the majority of men may not be wasted seeking baubles. Man may not live by bread alone. The engineer, especially, has been accused of materialistic ideals, and as one whose life is spent in a mechanical atmosphere and who often controls the spending of large sums, he is prone to over-rate the real value of these things in life. He, too, needs the broad culture that leads to a sane perspective of life and its high ends.—CONSTANT.

THE OUTLOOK FOR SANITARY ENGINEERING

Professor H. N. Ogden, '89

In a recent issue of the *Engineering News-Record* was a paragraph referring to the large number of men discharged from the Sanitary Engineering Section of the Surgeon General's division and to their immediate need of finding positions. It was asserted that at least 75 per cent of the 180 men involved are technically trained sanitary engineers and that, through their absence from the country in service, they are now quite out of touch with opportunities for work.

Such an apparent superfluity of sanitary engineers may well discourage a young man trying to pick out the profession for which he will train himself and either drive him into some other branch of engineering or even into medicine or law. Nor is this present failure of returning soldiers to find engineering positions waiting for them the only deterrent for college students choosing their profession. For the past ten years there has been an increasing protest on the part of engineering employees against their low salaries, their subordinate positions and generally, against the lack of recognition by the public of the responsibility and importance of their work. During the past year the engineering draftsmen of one of our large cities have formed a union in the hope of forcing from employers the rightful recognition that has not as they feel been granted them. Many comparisons have been made between the salaries of machinists and of the engineers for whom the machinists work, as well as between the intellectual preparation of the two groups and it is probably true that in many cases the engineer, with his years of preparation and with his personal responsibility for the success of the work in hand, gets a smaller financial return for his work than the skilled laborer under him.

But the money value of a day's work is not the only measure of the desirability of doing that particular work. One eminent engineer some years ago in advising a young man on the choice of a profession laid down the rule: "Pick out the kind of work in which you will find more pleasure than in any other conceivable task, more pleasure even than in eating a good dinner, and adopt that as your life work. If you can get paid for doing it, so much the better." Of course for most of us this rule would exceed the possibilities since to get paid enough to live on is a first consideration; but it suggests the wisdom of remembering that the satisfaction that comes from doing work that is personally agreeable is no small part of the compensation therefor and that without such satisfaction no work, however well paid for, has been well chosen.

Sanitary Engineering, viewed in this light, has many recommendations. It is not free from the more sordid considerations either. The field is comparatively new. Unlike the early railroad engineers who laid out the transcontinental lines and who now find little or nothing of that work to do, the sanitary engineer finds hundreds of cities and millions of people in immediate need, whether they realize it or not, of his services. The war with its world loss of man power and with its lessons of practical hygiene has driven home the need of conserving the individual life. And the ability of the sanitary engineer to design and maintain water supplies free from infective agencies, to care for human and industrial wastes so that the community shall not be inconvenienced or injured, to conduct necessary industrial processes at a minimum of toxic fatigue and without the escape of poisonous fumes and irritating dust, has proved his economic value to society.

The field is large and relatively uncultivated and the need for laborers in the field is beyond question becoming more and more appreciated. The constant reference to the need of the prevention of disease instead of its cure, the increasing demand in cities for competent full-time health officers, the enormous amounts of money devoted by state authorities to health work and the distinct shock to the whole country when it was found that among our drafted men at least thirty per cent were physically unfit, all indicate both the need and the importance of measures tending to make living conditions more healthful.

But men adequately trained to direct sanitary work are few. Even in so elementary a work as that of draining malarial districts for the elimination of the amopheles mosquito the War Department in the past two years has had to train its own men largely, the supply of college trained sanitary engineers being quite insufficient. For merely to have a knowledge of surveyng and of engineering construction is not enough for a sanitary engineer. He must interpret and apply the accumulated knowledge of bacterial and insect infection into defensive construction works. He must have so studied the enemies of health that he can intelligently plan an offensive campaign. To spend public money in building works, however appropriate in one place, in another place where the same need does not exist is an offense against the fundamental principle of engineering which is economy. Thus to plan drainage ditches for protection against malaria beyond the range of a mosquito's flight, to disinfect trade-wastes in which no pathogenic organisms exist, or to filter a drinking water that requires only disinfection are absurdities due entirely to a lack of real knowledge of the purpose of sanitary engineering work. Nor is such work capable of correspondence school methods of teaching. Every problem of sewage disposal, for example, is unique. There is no best method of treating sewage any more than there is any best method of treating a sick person. Judgment and experience as well as education are pre-requisites to the selection of the proper remedy in both professions. To be sure, no college of engineering, worthy of the name intends to teach its students to be tradesmen. The theory is that an engineering graduate has acquired the power to think and that while for a time he may run a transit or make tracings, his real training has given him the power to create and to direct others. Unfortunately, many graduates have been so absorbed in the task of learning to do things that their vision has been obstructed. They, although perhaps restless, are content to be directed by others and to overlook the larger problems in their microscopic study of the small problem assigned to them.

For real effective service in sanitary engineering therefore the profession needs cultivated, broad-minded, men. The young lawyer can become a clerk in a large office and remain on the salary list all of his life just as can the young engineer. But the lawyer of ambition is never content with this. He has his own office and his own clients before him from the first and means to be able independently to develop his every talent. So with the young doctor. But from lack of initiative, or because of a restricted outlook, the engineer wanders from office to office, following job after job, interested only in the salary that the job pays. To be sure the independent sanitary engineer has a more complicated task than the lawyer in establishing his practice. The latter finds his clientele among his friends, his neighbors, his fellow citizens. The sanitary engineer deals with municipalities and has to look to Boards of Public Works for his clients. He must therefore have a large mind, plenty of imagination, unbounded optimism and a ready adaptibility to many different conditions. He cannot wait in his office for clients to come in. He must find his work for himself and since personal association is generally responsible for getting desired work he must have a pleasing social address. Probably most of the business arrangements are made at lunch or at dinner. Business men in the cities realize that the disposition of the lunch hour always requires thought to make it most effective. The sanitary engineer to be successful will have to follow similar tactics. But if he does not know how to eat according to social conventions or if he has nothing to say in the general conversation that precedes the real business, the impression that he produces is unpleasant and his technical ability is discounted. He must be presentable at clubs if only to find opportunities for meeting persons of prominence. He must, if success is looked for, act and feel like a big man and then if his ability is really commensurate, he will in time find himself one.

Whether the profession is over crowded or not therefore becomes unimportant. What if there are draftsmen in large numbers hunting for jobs? What if large engineering firms do report that work is slack? There are in this country, 60,000,000 people for whom no sewerage facilities have as yet been provided and 75,000,000 people for whom some kind of sewage treatment works ought to be provided. About 16,000,000 people of this country are provided with a domestic water supply that has been properly filtered. At least as many more continue to drink surface waters more or less contaminated and for which some sort of purification should be provided. The field is large and waiting. None but large men however may hope to find a place therein.

In short, the aim of pure science is discovery, but the purpose of engineering is usefulness.

The delvers in the mysterious laboratories, the mathematical gymnasts, the scholars pouring over musty tomes of knowledge, are not understood by the work-a-day world, nor do they understand it. But between stands the engineer with keen and sympathetic appreciation of the value of the work of the one and a ready understanding of the needs and the requirements of the other; and by his power of adaptability he grasps the problem presented, takes from the investigators their abstract results, and transforms them into practical usefulness for the world.—WADDELL.

WATER PURIFICATION IN A QUIET SECTOR OF THE S.O.S.

Weston Gavett '11, ex-Captain U. S. A. Sanitary Corps

Having joined that distinguished organization of ex-regular army sergeants, property officers, psychologists and other ologists known as the Sanitary Corps, I had been confined for some time in one of the Southern camps where there was some water work to be done in checking the operation of the municipal filter plant and testing and posting wells. Finally fortune smiled and I was sent to France for work with the Water Analysis Laboratories of the A. E. F.

After the usual course through Brest and St. Agony I arrived at the Paris Headquarters of the W. A. L. the first of September, attaching a gas mask on the way which proved useful later in fighting our chlorine machines. In Paris it developed that I was to go to La Rochelle to start a Water Analysis Laboratory for the newly formed Base Section 7. The orders finally arrived giving time in the meanwhile to see the Folies Bergère and the Casino de Paris. Fortunately the Tours Laboratory had an extra set of Medical Field Laboratory-Chests, 1, 2, and 3, with equipment for bacterial work, which I picked up on the way to La Rochelle. The rest of the Laboratory, "Loot" K. M. Lampert, and Sergeant Wansher arrived in a day or so with two French Field Chests from the Paris laboratory. These were very useful with additional apparatus and reagents. We were pleasantly located at Camp Hospital 39 in a room adjoining the Hospital laboratory on one side the Morgue on the other.

At that time Base 7 was a busy and rapidly growing locality with two ports, the 35th Engineers building cars, another car plant and power plant, a large supply depot, the Talmat dock project and others under construction. This was keeping the Engineers busy furnishing water supplies for the mushroom camps. Much of the water was said to be of the poorest quality in France for boiler use and the laboratory had been requested for aid in locating supplies, overcoming trouble with boilers as well as supervising the sanitary quality of waters used and operating sterilizers.

Lieut. Colonel Bartow, Commanding Officer of the Water Analysis Laboratories reported on conditions and recommended that two water softening plants be installed. The plans for these had to be approved by Headquarters S. O. S., so since no soda ash was available locally, the Section Engineer sent with the plans a requisition for this chemical. Several months later, long after the armistice, the requisition returned from the official channels and eddies with the information that a sufficient quantity could not be obtained. We had rather anticipated this, however, and had started at once to try to relieve the condition of the boilers with the means at hand. The locomotive cranes were in such constant service that scale collected rapidly and injectors constantly clogged, discouraging frequent blowing off. Foaming caused further trouble and the situation was serious as a break down of the cranes would hold up the whole machinery of unloading boats and car building. The "Loot" having had considerable boiler water expeience in civil life was elected to look after this branch. Several things were tried but in general soda ash and a French boiler compound proved of value in preventing hard scale. Most of the locomotive cranes were in bad shape and as their construction made mechanical cleaning difficult, acid was used successively in loosening the old scale. This was done with care and laboratory control with no noticeable effect on the iron of the boiler.

The cause of the bad water was not hard to find. Samples of shallow wells showed a fairly good water but a deep well or one that had been pumped heavily gave results like the following—an analysis of the main supply of La Rochelle in December, 1918:

Chlorides	4180
CO_2 as $CaCO_3$	62
Alkalinity	240
Non Carbonate Hardness	588
Magnesium	179
Sulphates	400
Iron	0

(Results in parts per million.)

The only available supply was ground water, the upper layer of which was supplied by rain water and the lower layer by the adjacent ocean. In the summer of 1918 the rain failed to arrive and the sea water supplied the deficit. Because the water had not tasted very salty in previous years, the flavor of the water, together with the H. C. L., bad roads and dead dogs were credited by some to "les Americains".

Naturally this water was not relished by the hardworking wielders of shovels and hammers who were fighting the battle of La Rochelle. "Vin Blink" was much used but not recommended by the authorities, so any convenient well was used for drinking, if it tasted fresh.

The salt water of the city supply was safe as American chlorine medicines were installed in the two French plants and the one American station supplying the system. The shallow wells were good to taste but far from safe. Coffee made from the salt water was an excellent emetic so most organizations carried their water for drinking and cooking from private wells with tank wagons on trucks.

Under A. E. F. rules, the Engineers were responsible for main supplies and water points. Medical officers were supposed to worry about the treatment of Lyster bags in their organizations. Samples taken from these bags made us lose faith in their value. Each bag means a spearate purification unit and the chances of danger are multiplied by the number of bags. Medical officers were often too busy painting iodine to give their personal attention to the treatment and when a man was doing well with the work he usually would be transferred to something else. In some cases where the Medical or Sanitary officer had the time or inclination to properly supervise the treatment excellent results were obtained.

One of the French stations which supplied a small part of the total city supply obtained its water from a spring. This water was sterilized by a chlorine machine and was not salty. The logical thing to do seemed to be to call this a water point for supplying all organizations with drinking water. The plant was centrally located and all necessary was to install a riser pipe and valve to fill tank wagons. Permission was obtained from the Service de L'Eau and material and labor were at hand but General or Colonel Somebodyorother had to O.K. the project. This he failed to do on the grounds of bad transportation, in spite of the fact that practically every organization was already using various animal and motor transportation in hauling coli-laden water from Henri or Jean's barnyard well. A month or so later, however, General or Colonel Somebodyelseorother indorsed the proposition and the point was established. The pumps at this plant were of a wierd walking-beam type and had been installed in 1867 but were in excellent repair. Nevertheless the coal consumption was high for the water pumped and the plant was later closed when the larger city plant could supply the demand. The water point was then shifted to an American plant where a satisfactory supply had been developed.

About the time of the armistice we moved the laboratory to a room in the Section Engineers' office building where we were conveniently located with shelves and tables built to order. At the same time a carload of laboratory supplies, requisitioned on our arrival in the Base, appeared. Up to this time we had been able to work with the material from our chests but with considerable difficulty. Glassware for bacterial work was so limited in quantity that it had to be cleaned and sterilized almost every day. We had no analytical balance but had borrowed some standard solutions from the Paris laboratory before leaving. The A. E. F. methods for mineral analyses were all volumetric, except total solids and sulphates. Total solids were omitted and a turbidmetric method used for sulphates. The turbidity produced by barium chloride added to the acidified sample was compared with standards similarly treated at the same time, containing varying amounts of sulphuric acid. A table was prepared giving the parts per million of sulphates for different quantities of sample and cc. of acid used.

Several of the camps in Base 7 had water systems installed by the Engineers. These were of similar construction,—a dug well, gas engine driven pump, wooden elevated tank and pipe system. The water in all cases was unfit to drink without treatment. It was the policy wherever possible to sterilize all water furnished in mains, doing away with Lyster bags, owing to the fact that men will drink from hydrants if more convenient than the bags. A number of chlorine machines would have been required for these small supplies so an automatic Javelle extract feed was worked out that gave excellent results with material bought locally for a few francs. Javelle water or extract, a solution of sodium hypochlorite is largely used in France and can be obtained in most places at low cost. Tests showed that the amount of available chlorine varied some in different lots but a given solution kept its strength for some time. The feeding device was arranged so the only duty of the attendant was to fill the carboy once or twice a day with a measure of the extract and water and clean the orifice occasionally. At one plant a French employee who operated the pump looked after the chlorinator with good results and at a prison camp a German prisoner was successful in running the device.

We kept a supply of Javelle extract on hand at the laboratory and furnished a large amount for treating Lyster bags and water cans. For this purpose it was superior to the calcium hypochlorite tubes furnished by the Q. M. One of these tubes contains approximately one gram of hypo which added to a Lyster bags give a dose of about two parts per million. To break the tube and make a solution properly is not easy and the quantity of chlorine added is never the same, as the weights and strengths of the powder vary with different tubes. The Javelle extract was used for G. I. cans, water tank wagons and larger water tanks as well as Lyster bags. It was an easier and more accurate process and gave a safe water without a disagreeable after-taste. Chlorinated water in the army, is not in high regard due to the large excess usually added, and most men think that if a water does not taste of chlorine it has not been treated.

For the use of small detachments out on the road work we made up small kits consisting of a bottle of Javelle extract, a bottle of starch potassium-iodide solution, and a graduated pipette for the Javelle and plain pipette for the test solution all packed in a cigar box with directions and approximate quantities to add to different sized containers pasted in the cover.

Beside the continuous feed Javelle machines we had five Wallace & Tiernan chlorine machines in the La Rochelle district. Two were in French plants, two in American, and one treated the sewage of the Camp Hospital, where the stream carrying the effluent ran too close to the collecting galleries of the larger city water supply for comfort. These included the dry feed, pulsating and bubble type of machines. We had practically no trouble with the dry feed type but considerable attention had to be given to the machines with water connection, but this was more due to the nature of the water supplies than the machines. Variation in water pressure, air in the water, change in suction head on the pump, and back pressure when priming the pump all caused some difficulty and in some cases had to be corrected by additional devices.

In one case a glass check valve made of a Woulff bottle with various glass and rubber valves was used on the solution line to prevent back pressure reaching the machine when priming the pump and suction of air when the pump was running In another case where the chlorine solution line was attached to the solution line of a reciprocating steam pump trouble was caused by an increase of suction head on the pump due to a drop of level of the well, combined with the pulsating effect from the pump. This was overcome by running a short tube from the machine to a float valve connected with the pump suction, keeping a constant suction on the machine and preventing air suction to the pump. The valve was of the balanced type and was made in the laboratory of glass tubing and bottles. In spite of its fragile nature it worked well for a month and was in good shape when a more permanent arrangement was put in. Glass was the only material found that worked well in a chlorine solution without corrosion or gumming.

Our work was of course a very small and uninteresting part of the water work done in the A. E. F. In the S. O. S. dams, filter plants, softening plants, and large water systems were installed. Deep wells were driven giving artesian supplies and in our Base drilling outfits were operated and one well driven 600 feet in the hope of finding a fresh water supply, said by French geologists to exist under the salt water bed, but this work was abandoned with the armistice. The work at the front with mobile purification plants and laboratories was of great interest denied those in the S. O. S. Our work was little different from practice in the States except for the necessity of working with the materials at hand and dealing with the French authorities. Our relations in the latter respect were most pleasant. They took an interest in the chlorine machines installed in their plants, looked after them well and wished to buy them when our men left. The quaintness and history of some of the works were of interest. One town was still using a pipe line installed in 1750 and another was using a Roman acqueduct for a supply line.

The practice of water purification in the army was modernized to a remarkable extent during the recent war. No cases of typhoid were reported in our Base, and the few cases in the whole A. E. F., I believe, were traced to food rather than water. One is always led to wonder how methods might be improved in case the job had to be done again. To my mind there would be little radical improvement, but perhaps some refinements always made after new devices are used.

The Mobile Labs, complete laboratories mounted on a truck, were said to be very satisfactory but a side car or a flivver is desirable with them for reconnaissance and collecting samples. The need for properly selected laboratory equipment compactly packed in chests was found and the Paris lad made up several of these. It is surprising how much work can be done with material which can be packed in a small space. While in camp in the States the writer made a portable lab about the size of a suit case with which the following tests could be made: turbidity, color, soap hardness, specific gravity (for alum solutions), alkalinity, acidity, CO_2, iron, oxygen consumed, chlorides, total free ammonia (direct), and nitrites.

Bacterial work requires considerable bulk unless direct counting, cultures, or slides, are used or radical changes in technique.

For treating small supplies an improvement will undoubtedly be found over the hypo tubes now used.

One difficulty is that men away from places where treated water is furnished have to drink water at hand or go thirsty. Each man should be issued a supply of tablets similar to Halazone. One of these will sterilize a quart of water, the capacity of a canteen. The writer took over a bottle of 1000 tablets and could have used many more. Most were given away as in the case of an officer sent to Armenia where the poor water supply was a serious danger. Some were given to a French officer who gave the author some powders used by the French armies in the Colonies to test. A gram of one powder containing potassium permanganate and a filler is added to a liter of water and allowed to stand. A gram of the second powder containing sodium thiosulphate is then added destroying the excess of permanganate, and the water is filtered through paper or cloth. The results are excellent but the tablet method is much simpler and more apt to be used by the average man.

In Memoriam

HENRY GREGORY NORTHRUP, C.E., CLASS OF 1874

Died at Brooklyn, N. Y., October 14, 1919.

Harry Gregory Northrup, a member of the class of '74 of the College of Civil Engineering, died at his home 152 Gates Avenue, Brooklyn, N. Y., on October 14, 1919.

After graduation, Mr. Northrup entered the employ of the Tompkins County National Bank where he remained for six years. In 1881 he went to New York and took a position with Ivison, Blakeman, Taylor & Co., remaining with them until they merged with the American Book Company, then continuing in the employ of the latter. He retired about three years ago. He was a member of Kappa Alpha and the Cornell Club of New York.

PHILIP HENRY PERKINS, C.E., CLASS OF 1875

Died at Hudson, Wisconsin, September 23, 1918.

Philip Henry Perkins was born at Kennebunkport, Maine, January 12, 1854, and died September 23, 1918, at the Sanitarium at Hudson, Wisconsin, being 64 years old at the time of his death.

He attended Cornell University from which he received the degree of Bachelor of Civil Engineering in 1875 and of Master of Sciences in 1877; and for a short time after his graduation he was an instructor in rhetoric at Cornell.

Soon thereafter he came to Wisconsin and taught school at Jefferson and elsewhere and held a State Teachers Life Certificate. He then took up the law and studied at the University of Wisconsin and here received the degree of Bachelor of Laws in 1882. In this year he visited Europe and upon his return he entered into the practice of law at Madison in partnership with Charles E. Buell. While in Madison he was prominent in public affairs and at one election he was the Republican candidate for County Judge of Dane County.

In 1887 he moved to Superior upon the investigation of Ira W. Burhans, a prominent lawyer of that time, and they formed the partnership of Burhans & Perkins which continued for some years. After this firm was dissolved he practiced alone.

In 1893 he was City Attorney of Superior and in 1896 Assistant City Attorney. He was President of the Board of Education of Superior, President of the Superior Public Library and President of the Douglas

County Bar Association at different dates; for many years he served as one of the Wisconsin Commissioners having charge of the Interstate Park at St. Croix Falls. He was a Court Commissioner of the Douglas County Court and also United States Court Commissioner. Upon the death of Judge L. S. Larson, County Judge of Douglas County, in 1914 he was appointed by Governor McGovern to fill the vacancy. He was elected to fill out the unexpired term and then was elected for the full term and he was holding this office at the time of his death.

All of these positions he filled with ability and the various duties which thus came to him he performed faithfully and conscientiously. As City Attorney the conduct of important litigation fell to him, for this was just after the "boom" and the City's affairs were greatly complicated, and he took care of this litigation and the difficult problems involved skillfully and to the best interest of the public. Mr. Perkins was modest and retiring in his manner, but not cold; and those who knew him intimately found him warmhearted and friendly. Indeed this must have been generally understood for he was universally called "Phil" evidencing that people appreciated that in spite of his dignified manner he was not only an able lawyer and useful citizen but a "good fellow" as well. He was a musician, and had a keen appreciation for the best in music, and in art and literature.

He was married in 1890 to Miss Katharine M. Briggs of Madison, who survives him.

LEWIS RICHARDSON PUFFER, C.E., CLASS OF 1914

Killed March 21, 1918 at Hartford, Connecticut.

Lewis Richardson Puffer, '14, was instantly killed on March 21, 1918, by being run down by a switching engine in the freight yards at Hartford, Conn., where it is supposed he went in search of some missing freight.

Puffer entered the College of Civil Engineering in 1910 and received his degree in 1914, As an undergraduate he was a member of Delta Upsilon and Rod and Bob, and also sang in the glee club in his junior and senior years. After graduation he became associated with J. W. Bishop Company, contractors of Boston and later was employed in the Engineering Department of the Automatic Refrigerating Company at Hartford, Conn., retaining this position until the time of his death. Early in 1918, Puffer entered the Air Service and began training at M. I. T., received his ground work at Cornell and was assigned first to Eberts Field, Lonoke, Ark., and later to Camp Dick, Dallas, Tex., where he was honorably discharged at the signing of the armistice.

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EDITORIALS

The Future With this issue of THE CIVIL ENGINEER commences the thirteenth year of publication as a monthly and publishes the first number of the twenty-eighth volume,—the Transactions of the Association of Civil Engineers, an annual, having been for fifteen years the Cornell C. E. undergraduate publication. The year just entered upon will be the last year of the existence of the College of Civil Engineering as a distinctly individual college of the University since consolidation of the College of Civil Engineering and Sibley College will commence to be operative next Fall for the Freshman class and in the Fall of 1921 for all other classes.

It has in the past been the aim of THE CIVIL ENGINEER to serve as a link between the alumni and their college, to keep them in touch with each other, and to serve as a medium for the exchange of their ideas and experiences. There are normally four times as many alumni subscribers as student subscribers and THE CIVIL ENGINEER, therefore, has always been essentially a publication of the alumni. It is believed that the alumni of the College of Civil Engineering will want this policy to be maintained in the future and will look with disfavor upon any change which will involve the abandonment of the personal touch between their college and themselves.

Special Numbers

At the suggestion of one of the college's foremost alumni, Mr. Clyde Potts, '01, and with the encouragement of the generous assistance of Mr. Potts and Mr. Clinton L. Bogart, '05, it has been decided to adopt the policy of making each issue a special number. It is believed that this scheme will make THE CIVIL ENGINEER more attractive to subscribers and advertisers, and will also make it possible to secure good articles with much less difficulty. In accordance with this plan the October issue is a Sanitary Number. The prompt and practical response to this issue's authors was a real encouragement and only this sort of support can make this project a success.

A Service Number will be one of the early issues. It is hoped to include in this the complete record of every alumnus who was in his country's service during the war. Questionnaires will be sent within a few days to every man whom we knew to have been in service. Please fill yours out completely and mail it promptly. If you were in service and do not receive a questionnaire drop us a card and one will be sent you. We will appreciate information regarding the service record of C. E. men who did not graduate and of whom we therefore have no record. This issue will constitute a service record of Cornell C. E. graduates in permanent form and will be an appropriate memorial to our men who laid down their lives in the great cause.

A Small Sewage Disposal Plant

Engineers are so extensively associated in the design, construction, and operation, of engineering works of considerable magnitude that often times the application of the prinicples of economy to the design and construction of small jobs is not successfully made. Gustave J. Requardt, '09, in this issue describes the design and construction of a small sewage disposal plant which was built to take care of the sewage from a High School of about 500 pupils. Mr. Requardt for several years has been connected with the well-known engineering firm of Norton, Bird & Whitman of Baltimore. His article describes a very good example of economy as applied to the construction of a small plant.

The Outlook for Sanitary Engineering

We are very glad to have for this issue the estimate of the prospect for sanitary engineers of Professor H. N. Ogden, '89. There is hardly another engineer in the country so eminently qualified to render judgment as to the need and the field for sanitary engineers and none is better qualified to write of the requisites for success of a sanitary engineer. His training, his practice as a consulting sanitary engineer, his intimate knowledge of all of the phases of Sanitary Engineering, and his connection with the New York State Public Health Council and other public health boards conduce to give him an especially keen insight into the real need for men adequately trained to direct sanitary work. His years of teaching, his acquaintance with and observation of hundreds of embryo engineers, with many of whom he has since kept in touch, give him an unusual perspective and enable him to point out, as he does in this issue, the factors which make for the success of an engineer. For these reasons Professor Ogden's article will be of especial interest not only to present undergraduates but to his former students—undergraduates of the past—as well.

Disinfection of Sewage

Public health work in this country in recent years has made great strides in the direction of the prevention as well as the control and cure of disease. This, of course, was a natural development as soon as the resources of public health boards were not entirely exhausted by the more pressing demands of control and cure and as soon as the public was educated to appreciate the value of disease-prevention measures. Probably no phases of this work have received more attention than the provision of water free from disease-producing organisms and the disinfection of the sewage of municipalities. Mr. Chester G. Wigley, '07, describes in this issue some instances where chlorine and its compounds were used with excellent results in the sterilization of sewage. He includes tables showing the results of bacteriological examinations extending over several months of the sewage of the city of Millville, N. J., and of Camp Merritt.

Mr. Wigley was formerly Chief of the Department of Engineering of the New Jersey State Department of Health. He is now Supervising Engineer for the Wallace & Tiernan Co., of 349 Broadway, New York City.

Water Purification in the A. E. F. In his article "Water Purification in a Quiet Sector of the S. O. S.," Mr. Weston Gavett, '11, formerly a Captain in the Sanitary Corps, A. E. F., describes in a very interesting way some of the problems and difficulties which confronted the Sanitary Corps in the Service of Supply and were solved by it. Very soon after his arrival in France Captain Gavett was given the commission of establishing a Water Analysis Laboratory at La Rochelle for Base Section 7. He says that the practice of water purification in the army was modernized to a remarkable extent during the recent war and this statement is supported by the numerous instances he gives. Captain Gavett is now with Mr. Clyde Potts, '01, at 30 Church St., New York City.

Price of Subscription Commencing with the October issue the price of subscriptions to THE CORNELL CIVIL ENGINEER will be $2.50 a year. It is with a great deal of reluctance that we make this announcement for the price of subscription has up to this time remained at the figure set by the first board of the CIVIL ENGINEER in 1907. The advance in price now made represents less than 50 per cent of the advance in the actual cost of publication, but it is our hope that this, with increased support from C. E. alumni will be sufficient to tide us over to the period of lower prices. By the extent and vigor of the loyal and helpful support of alumni more than by the ability of the undergraduate board is the success of the CIVIL ENGINEER measured. A greater percentage of our graduates should be subscribers. You can aid us in our effort to increase our circulation by *keeping up* your own subscription. A larger number of alumni should find it possible and desirable to have their professional cards in THE CIVIL ENGINEER. These are practical and substantial forms of support and backing of this sort will make THE CIVIL ENGINEER a journal worthy to represent the College and Cornell C. E. alumni.

COLLEGE NOTES

Brighton, N. Y., June 11, 1919.

Dr. Jacob Gould Schurman, President.
Cornell University,
Ithaca, New York.

Dear Sir:

Library of the Late Emil Kuichling Given to College

It is my desire to present to the College of Civil Engineering at Cornell, or to the College of Engineering, if these departments are later merged, the professional library of Mr. Emil Kuichling, A.B., C.E., late of Rochester and New York, N. Y. (not including periodicals). It is a condition in making this gift that the College will keep the hydraulic and sanitary library as a separate unit to be known as

"The Kuichling Library"

in a room by itself, and mark each book with a label stating that it is from the library of Emil Kuichling, and will make additions thereto from time to time of desirable publications or other material to extent of the income of $1,000 endowment, from the time when such endowment shall be received by said college from me.

I have had the library indexed. It will require about 170 square feet of shelf space. Also I am having mounted and framed certain drawings and special material, which, upon consultation with the College of Civil Engineering, has been deemed of advantage to be on permanent view for the students.

Very sincerely,
(Signed) Sarah L. Kuichling.

It is becoming a matter of common knowledge in University circles here and abroad, and in industrial establishments interested in the solution of hydraulic questions that the Cornell Hydraulic Laboratory at Triphammer Falls offers an opportunity for large scale experimentation unique in the history of Hydraulic science. Potentialities here are such that Cornell should take the lead in extending the confines of knowledge in this field. Large volumes of water for long periods from Beebe Lake are available, while other institutions are dependent upon small volumes obtained by pumping.

In the light of this opportunity a deeper significance is added to the gift announced in the above letter from Mrs. Kuichling to the College of Civil Engineering of the Hydraulic and Sanitary Library of the late Emil Kuichling, a noted Hydraulic engineer who has occasionally lectured at Cornell. This very large and valuable collection covers fifty years research in English, German, French, Italian and Spanish by the most profound student in Hydraulic and Sanirary Science our country has seen. Beside containing all the standard works on Sanitary and Hydraulic engineering it is especially notable in that it contains a large number of privately published special reports of municipalities and other engineers, which it is impossible to buy. Coupled with the laboratory it should make Cornell the instrument of great service to graduate students, and with proper expenditures upon the laboratory, the center of progress in this field.

1919 Summer Camp

For nearly five weeks during the months of August and September, Cornell's C.E. students were kept busy at their annual Summer Survey Camp. The section surveyed this year was located around Sheldrake Springs, about 23 miles north of Ithaca, and on the west side of Cayuga Lake.

The work was arranged in such a manner as to give every man experience in all of the numerous types of work. In addition to the work in topography, parties were sent out daily on hydography, topographic and precise levels, base-line work, and triangulation. Asst. Prof. P. H. Underwood was in charge of the camp and was ably assisted by six other members of the C.E. faculty. About seventy-two C.E. and twelve Forestry students attended the camp.

In our November issue there will appear an article by W. A. Andrews, '19, Chief Engineer of Camp, giving more of the details and relating some of the numerous interesting incidents which occurred.

Football Cornell's football prospects seemed fairly bright at the beginning of the season but in the three games which have been played the Varsity has failed to develop the expected strength.

There were several former Varsity men in the large squad which turned out for the first practice on September 15, among them Shiverick, the great quarter, who played on the championship team of 1915 and on the 1916 team.

The Oberlin game on October 4 was won without much difficulty by a touchdown and a field goal, all of the scoring being done by Shiverick. The Williams team on October 11 offered very much more determined opposition and it was only in the last few minutes of play that a well-directed kick from Shiverick's toe made it Cornell's game.

With one of the fastest and most versatile backfields seen here in years, a powerful offensive that forced the fighting from the very beginning, Colgate triumphed over Cornell on Schoellkopf Field on October 18 by the score of 21 to 0. The largest early-season crowd in local football history saw Cornell go down to defeat, fighting stubbornly if at times blindly, overpowered by the fast running of Anderson and Watkins and the hard hitting of Gillo and Baird.

The Varsity was outplayed and outmanoeuvered but not outgamed. The only bright spot in the game, except for some good defensive work in the first period, was when Shiverick picked up an attempted placement kick by West in the last period and ran from his ten yard line to his thirty yard line before he was downed.

Cornell faces some hard games before the close of the season and although outplayed by Colgate still looks forward confidently to making a very favorable showing by winning the remaining games.

The schedule for the balance of the season follows:

October	25	Dartmouth at the Polo Grounds, New York.
November	1	Lafayette at Ithaca.
November	5	Carnegie Tech. at Ithaca.
November	15	Penn. State at Ithaca.
November	28	Pennsylvania at Philadelphia.

Faculty Changes O. M. Leland, Professor of Astronomy and Geodesy, and Head of the Department of Topographic and Geodetic Engineering, and Prof. S. G. George, '05, Head of the Department of Mechanics, are on leave for the first term of 1919–1920.

Herbert H. Scofield, a graduate of Sibley College of the class of 1905, has been appointed to fill the vacancy caused by the death of Assistant

Professor A. P. Mills, former head of the Materials Department. Mr. Scofield has for several years been engaged in teaching at Purdue.

Mr. J. E. Weber comes from the Troy Polytechnic Institute where he has been a member of the instructing staff and will have surveying and hydraulic sections.

C. M. Pendleton, '18, is instructing in descriptive geometry and surveying. Mr. Pendleton was an instructor in the Geology Department last year.

C. E. O'Rourke, '17, is an instructor in the Bridge Department. During the war he was in the Air Service and was an instructor in the School of Military Aeronautics at Cornell.

H. P. Odyssey, '21, who is a student in the College is an instructor in Drawing.

First Term Registration

The total registration of regularly matriculated students this year was 5,152 on October 12th.

This is the highest registration at the beginning of the year in the history of the University. The previous maximum total was in 1916 when approximately 4,700 students were registered. This figure was increased to about 5,500 at the beginning of the second term so that it seems reasonable to suppose that a corresponding increase this year will bring the total registration to 6,000. This large registration is due in part to the return of old students from the war and in part to the large number of men in the entering class. The registration in the College of Civil Engineering is approximately what it was in the Fall of 1916 and is expected to exceed that figure.

ALUMNI NOTES

'82. F. S. Washburn has been appointed chairman of the New York committee of the Cornell Endowment Fund. Mr. Washburn was a trustee of the University from 1895 to 1902.

'86. O. L. Ingalls is Assistant Engineer in the U. S. Engineer's Office at Galveston, Texas.

'86. Charles B. Wing, 345 Lincoln Avenue, Palo Alto, California, is Professor of Structural Engineering at Stanford University.

'91. Ph.D. W. K. Hatt has resumed his duties as head of the School of Engineering at Purdue University after being on leave of absence since January 1, 1919, on government service.

'91. Edwin Hilborn has changed his address to 716 Park Avenue, Herkimer, N. Y. He is still with the Department of the State Engineer and Surveyor.

'92. Victor H. Poss is Chief Structural Engineer of the San Francisco Shipbuilding Company, Government Island, Oakland, California. In this capacity he designed the hull of the concrete ship *Faith.* His address is 2929 Russell Street, Berkeley, California.

'93. H. K. Bishop is Chief Engineer for the state Highway Commission of Indiana.

'93. Robert H. Jacobs, Division Engineer of Tracks for the N. Y. State Public Service Commission of the First District has been transferred to full membership in the American Society of Civil Engineers. His address is 49 Lafayette Street, New York City.

'93. Col. H. R. Lordly has returned from overseas where he served with the Canadian Expeditionary Forces. Col. Lordly is spending the year in graduate study at Cornell before resuming his practice as consulting engineer.

'93. The Robbins-Ripley Company of 50 Church Street, New York City, recently announced that Mr. R. T. Betts formerly Deputy Chief Engineer, Department of Docks, City of New York is associated with the company as Chief Engineer. John W. Ripley, '93, is vice-president of the Company.

'94. S. I. Kehler is a Civil Engineer in Baltimore. His address is 1800 Oakley Street.

'95. Abraham Gideon is Managing Director of the Metropolitan Water Supply of Manila. He resides at the Army and Navy Club.

'95. William Henry Ledger, Designing Engineer for Metropolitan Railway Construction in Sydney gives as his address "Railway Crescent" Beecroft, Sydney, New South Wales. He is a member of the Institute of Civil Engineers.

'96. Frank S. Senior of Montgomery, New York, is Vice-President of Arthur McMullen Company, 149 Broadway, New York City.

'97. Elroy Theodore Agate is Engineer of Construction with Hydro Electric Power Commission of Ontario and has an office at 14 McMaster Avenue, Toronto.

'00. Squire E. Fitch is Division Engineer with the New York State Highway Department at Utica, N. Y.

'00. Willard O. White of 150 Stockton Avenue, Uniontown, Pa., is Chief Engineer with W. J. Rainey.

'03. W. S. Edge has changed his address to 122 N. Euclid Avenue, Westfield, New Jersey.

'03. Captain E. D. Hendricks has been appointed Division Engineer of the Eastern Division, New York State with headquarters in Albany. Work on all canals and terminals east of Utica will be under Capt. Hendricks' supervision. Captain Hendricks was cited by General Pershing for distinguished service with the 303d Engineers in France.

'03. L. S. Hulburd is Senior Assistant Engineer, New York State located at 50 Triangle Building, Rochester.

'04. R. C. Bennett, Engineer with the National Board of Fire Underwriters, 76 William Street, New York City has been elected as Associate Member of the American Society of Civil Engineers.

'05. Lt. Col. F. W. Scheidenhelm has resumed his practice in association with Daniel W. Mead. Col. Scheidenhelm was in command of the 26th Engineers and acted as Water Supply officer for the First Army. He was cited by General Pershing "for exceptionally meritorious and conspicuous service."

'05. Lieut. Frank C. Tolles is Superintendent of Sanitation, Department of Public Service, Akron, Ohio.

'05. Lef F. Winship, Assistant fo Chief Engineer, Northern Pacific Railway, 4138 Cleveland Avenue, St. Louis, Mo., has been elected an Associate Member in the American Society of Civil Engineers.

'06. Arthur V. Foard of 1602 Linden Avenue, Baltimore, Md., is Assistant Superintendent of the Maryland Dredging and Contracting Company.

'06. Robert Coltman, Jr., has become Construction Engineer for the American Mongolian Trading Company at Kalgan, China.

'06. Enrique Ruiz Williams, Contreras 70, Matanzas, Cuba is General Manager Ca Servicios Publicos de Matanzas, Cuba.

'07. Capt. W. E. Darrow has received his discharge and has returned to his position as Assistant Engineer, New York State Highway Department, with headquarters at Utica.

'07. Cecil B. Hopkins is President and Manager of the Steelform Contracting Company of 681 Market Street, San Francisco, California.

'07. Edwin Clifford Williams is Assistant Accountant with the Standard Oil Company of New York. at Shanghai, China. He says that there are more graduates of Cornell in the Company than of any other college, and writes that he will visit Ithaca in 1920.

'08. C. M. Baker, who is now State Sanitary Engineer of the State of Wisconsin writes: "Subsequent to severing my connection with the New York Department of Health, I was employed with the United States Public Health Service in the control of Malaria first at Macon, Georgia and later at Nashville, Tennessee, until the singing of the armistice. Later in the same capacity I was assigned to the Tennessee State Board of Health for the purpose of organizing an engineering division in connection therewith."

"The need of sanitation in the South is urgent and I believe that there will be good openings for sanitary engineers in this section of the country because it is apparent that there is to be considerable development throughout the South in the near future. I have recently severed my connections with the United States Public Health Service to accept my present position as State Sanitary Engineer for the State of Wisconsin and believe that I am going to find some very interesting problems here."

'08. John Condon is Contract Manager of the Turner Construction Company of 244 Madison Avenue, New York City. His address is 1713 Sansom Street, Philadelphia, Pa.

'08. C. W. Diefendorf gives his address as 3232 Chestnut Street, Philadelphia, Pa.

'09. Robert Lee Fox, City Engineer of Bethlehem, Pa., has been elected an Associate Member of the American Society of Civil Engineers.

'08. Wm. E. Spragins, University Club, Salt Lake City, has a wholesale stove and range business at 702 Walker Bank Building, Salt Lake City. For two years he was in the Engineering Section, O. R. C. as a Major.

'09. Captain G. R. B. Symonds has been discharged from service and has been appointed highway engineer, District 9, Bureau of Public Roads.

'10. Merwin Armstrong of 332 State National Bank Building, Texarkanna, Arkansas, is engaged in levee construction. He is an Associate Member of the American Society of Civil Engineers.

'10. Capt. H. F. Bronson is now Sanitary Engineer with the Pennsylvania State Department of Health. His address is 1855 Zarker Street, Harrisburg, Pa.

'10 W. B. Clift is Vice-president of the Omaha Trust Company, Omaha, Neb. He lives at the Blackstone Hotel.

'10. Captain E. W. Day has returned from France and is employed by the Electric Bond & Share Company, New York City.

'10. G. P. Donnellan was mustered out of service June 5 and now is with Coverdale & Colpitts, 66 Broadway, New York City, located on their Texas oil properties. His address is Care Continental Supply Company, Ranger, Texas.

'10. P. S. Monk, Sloansville, New York, is Structural Engineer, Division of Valuation, Interstate Commerce Commission, 46 Municipal Building, Chattanooga, Tenn.

'10. Lieut. Fred Leroy Stearns has been discharged from service and gives his address as 173 Hicks Street, Brooklyn, New York. He was recently transferred from Junior to Associate Member in the American Society of Civil Engineers.

'10. Edgar Myers Wilson is an operative builder at 5156 Haverford Avenue, Philadelphia, Pa. He received his discharge January 27 from the Ordinance Department of the Army in which he was a Second Lieutenant. He married Miss Jean Gould DeHaven of Philadelphia March 25.

'10. Capt. G. B. Woodruff is in the Bridge Department of the Lehigh Valley Railroad Company at South Bethlehem, Pa.

'11. Clarence H. Davidson is Designing Engineer with the Bureau of Public Works, Manila, P. I. He is at present designing a new reinforced concrete pier for which $1,500,000 has been appropriated.

'11. The following is taken from *The Harrisburg Telegraph:* J. Raymund Hoffert, of Harrisburg, a civil engineer, lately with the Harrisburg Park Department, Pennsylvania Steel, Central Construction and various corporations, has been appointed assistant engineer in the engineering division of the State Department of Health. He is a Cornell graduate and attended Hamilton Institute. He is well known to many Harrisburgers."

'11. C. P. Rhynus has changed his address to Maryville, Tenn.

'11. Gustave Schirmer gives as his new address 3832 West Monroe Street, Chicago, Ill.

'12. Capt. R. W. Austin received his honorable discharge in August and may be addressed at his home 612 Myrtle Avenue, Albany, New York.

'12. H. S. Chuck of Hankow, China, is Manager of the Pacific Trading Company, Importers, Exporters, Engineers, and Contractors, Whiteaway, Laidlaw Building, R. C. Kankow.

'12. Walter C. Conger was married June 11 to Miss Agnes Winifred Wood of Palisades Park, New Jersey. The Congers reside at 235 Lora Avenue, Youngstown, Ohio.

'12. James E. Cuff, Assistant Engineer with the New York State Highway Commission at Syracuse, New York, has been elected an Associate Member of the American Society of Civil Engineers.

'12. Lieut. M. A. Darville was married on June 14 to Miss Isabel Shepard, '10, of Honeoye Falls, New York. Mr. and Mrs. Darville are at home at 549 Decatur Street, Brooklyn, New York.

'12. Roland R. Graham has been discharged and is now with the American Bridge Company at 30 Church Street, New York City. He was recently transferred from Junior to Associate Member in the American Society of Civil Engineers.

'12. Harold J. Levine, member of the firm of Kaufman and Levine, Consulting and Industrial Engineers, 21 East 40th Street, New York City has been elected an Associate Member of the American Society of Civil Engineers.

'12. Elmer F. E. Schmidt, 3615 Rawlins Street, Dallas, Texas, is with the Lone Star Gas Company whose office is in the American Express National Bank Building.

'12. Edward Hooker Taylor is now an engineer with the Austin Company, 16112 Euclid Avenue, Cleveland, Ohio. He landed in New York, May 27, after 20 months' service overseas as First Lieutenant and later Captain of Engineers. He served the entire period as aide-de-camp to General Meson M. Patrick, who was Director of Construction and Forestry from September, 1917 till May, 1918, and Chief of Air Service, A. E. F. after May, 1918. Taylor was discharged from the army June 17.

'12. William A. White of 1600 Eutaw Place, Baltimore, Maryland, is engaged in Shipbuilding at Baltimore.

'13. H. A. R. Austin, 14 Capitol Building, Honolulu, T. H., is Assist. ant Engineer, Division of Hydrography. He was married to Miss B. M. Hancock of Riverside, California the latter part of June.

'13. Roger S. B. Hartz has been promoted to Lieutenant Colonel and may be addressed at Camp Holabird, Maryland.

'13. William Kessler has moved from 2035 Channing Street to 1446 Euclid Street, Berkeley, California.

'13. Major Alexander Lyle was married on June 11 to Miss Eleanor Louise Armstrong at Brooklyn, New York. They reside at 203 Underhill Avenue.

'13. F. Barnard O'Connor, Assistant Chief Engineer and Director of the Alphons Custodis Chimney Construction Company, 95 Nassau Street, New York City, has been elected an Associate Member of the American Society of Civil Engineers.

'13. Captain Charles Weiss, 66th U. S. Engineers (Railway Operating) was discharged from service on July 30 and became Assistant Supervisor for the Pennsylvania Railroad at Dunkirk, New York on August 1. He was with the same road before going into srevice but was then located at Pittsburgh, Pa.

'14. J. S. Bailey has returned from France and is employed by the Portland Cement Association, Hurt Building, Atlanta, Georgia.

'14 A. M. Field has become associated with Charles C. Hopkins under the firm name of Hopkins & Field, Consulting Engineers, Cutler Building, Rochester, N. Y.

'15. Charles R. Adelson is with the Golead Manufacturing Company, 25 Waverly Place, New York City.

'15. A daughter, Catharine Loomis, was born on May 14 to Mr. and Mrs. Edwin S. Baker, 9610 Clifton Boulevard, Cleveland, Ohio.

'15. Lieut. C. C. Cooman is in the Engineering Department of the Sinclair Refining Company, Conway Building, Chicago, Ill.

'15–16. Carlyle D. Geisler, graduate student in 1915–16 is at Williston, N. Dak. and inquires if there are any Cornell Engineers he could get in touch with in that part of the country. He says they need good highway engineers.

'15. J. R. Grime of Arlington, N. J. is in charge of contrsuction work at the Arlington Works of the duPont Company.

'15. John E. Harn, Secretary and Treasurer of Wm. E. Harn, Inc., Builders, 213 Calvert Street, Baltimore, Maryland, has been elected a Junior in the American Society of Civil Engineers.

'15. Lieut. G. F. Healey has entered the Bureau of Public Roads, Washington, D. C.

'15. Lieut. Thomas F. Keating, Jr., is employed in the New York office of the Lehigh Portland Cement Company. He lives at 11 East 87th Street, New York City.

'15. David N. Milhan, 4943 Grand Boulevard, Chicago, Ill., is with the Engineering Department of the Sinclair Refining Company, Conway Building, Chicago. He was First Lieutenant in the 106th Engineers. Besides Milhan, Cooman, '15, Wright, '15, Briggs, '17, and McNair, '18, are in the same office.

'15. Lieut. A. S. Patrick received his honorable discharge on June 3 and attended the Semi-Centennial Celebration. He is now with the Texas Company and gives 509 East Fifth Street, Brooklyn, N. Y. as his address.

'15. I. Russell Riker of 62 Crane Street, Caldwell, N. J., is now Assistant Sanitary Engineer in the New Jersey State Department of Health. He was discharged from the army August 1. He had been Officer in Charge of Water, Sewage, and Sanitation at Camp Meade, Maryland.

'15. John K. Rose has changed his address from Waco, Texas, to 407 West Oak Street, Carbondale, Ill.

'15. Lieut. J. R. Rosenfeld is Special Agent with the Edward A. Woods Company, General Agents for the Equitable Life Assurance Society, at Pittsburgh, Pa.

'15. In a letter to Professor F. A. Barnes under date of September 14 Alan F. Williams describes an interesting transcontinental trip which he took this summer.:

"We went via Easton, Reading, Gettysburg, Dayton, Indianapolis, Springfield, St. Louis, Kansas City, Hutchinson, Pueblo, Canon City, Colorado Springs, Denver, Salt Lake City, Tonopah, Lake Tahoe, Sacramento, Merced, Yosemite Valley, San Francisco, Los Angeles, and Blyth.

"We had a wonderful trip and a great time. We stayed at hotels all the way except across the desert where we slept out. Wherever there was anything to see, we stopped and saw it. We stopped one or two days in all the large cities for sight seeing, and drove up to the top of

Pike's Peak, Royal George, went along Lake Tahoe, saw the big trees and went in the Yosemite Valley for three days. The scenery was wonderful, especially in California and Colorado.

"We were 22 days on the road (not counting the days sight-seeing, etc.) and averaged 21 miles an hour for the trip. We went over 6000 miles altogether.

"The roads are all concrete or asphalt as far as Indianapolis. Illinois had the worst roads we struck on the entire trip. From Indianapolis west the roads were chiefly dirt, with some gravel, except in the big cities, where it was ashpalt or concrete. In Utah and Nevada there were no roads at all in places across the desert except natural desert road on a dry river bed which would be impassible in wet weather. (Nevada, however, has only 50,000 inhabitants in all.) It seemed like getting into Heaven to strike the good concrete and asphalt roads of California. California has a wonderful system of good roads.

"After two weeks at home I went back to work for the Santa Fe again and arrived out here (Williams, Arizona), last Saturday as transitman of a maintenance party covering from Seligman, Arizona to Winslow and from Williams to the Grand Canyon. There are only three places of 1500 population on the whole district so you see it isn't very thickly populated.

"It is beautiful country up here 6800 feet above sea level. It is fine timber country and is in the Forest Reserve. The chief industries are lumbering and raising sheep and cattle. You see plenty of cow punchers around here rounding up for fall shipment.

"The Grand Canyon is on my territory and I expect to get up there soon. In winter we get 60 feet of snow here but it goes away quickly after each storm. However I shall soon see some pretty cool weather.

"There is nothing much to do here but work. Still I have been practicing baseball three nights a week and am playing on the local team. I have worked off ten pounds and am now down to 200."

'16. L. Feldman has changed his address to 883 Longwood Avenue, New York City.

'16. W. L. Havens, who is Senior Assistant Sanitary Engineer, in the Division of Engineering and Construction, Department of Public Service, City of Cleveland, has recently recovered from an attack of the "flu." He writes: "I have been in the employ of the City of Cleveland about three years now and enjoy the work very much. In that time I have had varied duties, including testing station studies, design, and construction work. I find that Cleveland is certainly a live Cornell town and meet some of the fellows I knew, or had heard of, almost every day.

"Please remember me to any of the '16 fellows you see and tell them I would be glad to hear from them. Incidentally, if you know of any men who are looking for design work, ask them to write to the Sub-Division of Sewage Disposal."

'16. H. S. Lee of Yu Yao, Chekiang, China, is English Secretary to the Chief Engineer, Tientsin Pukow Railway, Tientsin, China.

'16. Jack T. Nash who was overseas as 2d Lieutenant in the 524th Engineers has resumed his connection with the Henry Exall Elrod Company as Chief Office Engineer at Dallas, Texas.

'16. Leslie E. Pierce of 129 Grove Street, Stamford, Connecticut, when heard from late in June, was in charge of the S. & A. Branch, Airplane Department, Engineering Division of Air Service at McCook Field, Dayton, Ohio.

'16. James J. Wall, Jr., of Duluth, Minn., saw 19 months' service in the A. E. F. as Captain in the 2d Engineers. He was once wounded, was awarded the Croix de Guerre at Mont Blank, and was cited by Gen. Pershing for distinguished conduct in the Meuse-Argonne. Harold L. Hock, '16, also served with the 2d Engineers.

'17. Major David Beale is working on the irrigation of the Diamond Ranch at Diamond, Wyoming. This ranch covers more than sixty thousand acres and is one of the largest in the country.

'17. Lieut. C. B. Benson, who has been employed as Transitman for the New York State Railways at Rochester, New York, has accepted a position as Instructor in Mechanics in Sibley College for the coming year.

'17. John H. Courtney, 1411 West Street, Wilmington, Delaware, is in the Harlan Plant of the Bethlehem Shipbuilding Corporation.

'17. B. Friedenberg, Aid, U. S. C. & G. S., who has been working on a survey of the islands St. Thomas and St. John, Virgin Islands for the Navy Department, has received orders to report back to Washington. His address is Care U. S. Coast & Geodetic Survey.

'17. Lieut. R. T. Gilbert, U. S. N., was detached from service May 30 and is now Assistant Manager of the rolling mill of the New Jersey Zinc Company. His address is 536 West 113th Street, New York City.

'17. Captain L. D. Kingsland, II, was stroke in the A. E. F. crew which took part in the Henley regatta on July 4th.

'17 M.C.E. K. Lee has left the employ of the New York Central Railroad and is on his way to his home in Shanghai, China.

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The Class of 1923

THE CORNELL CIVIL ENGINEER

and

Transactions of the Association of Civil Engineers
of Cornell University

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SUMMER SURVEY OF 1919

W. A. Andrews, '19

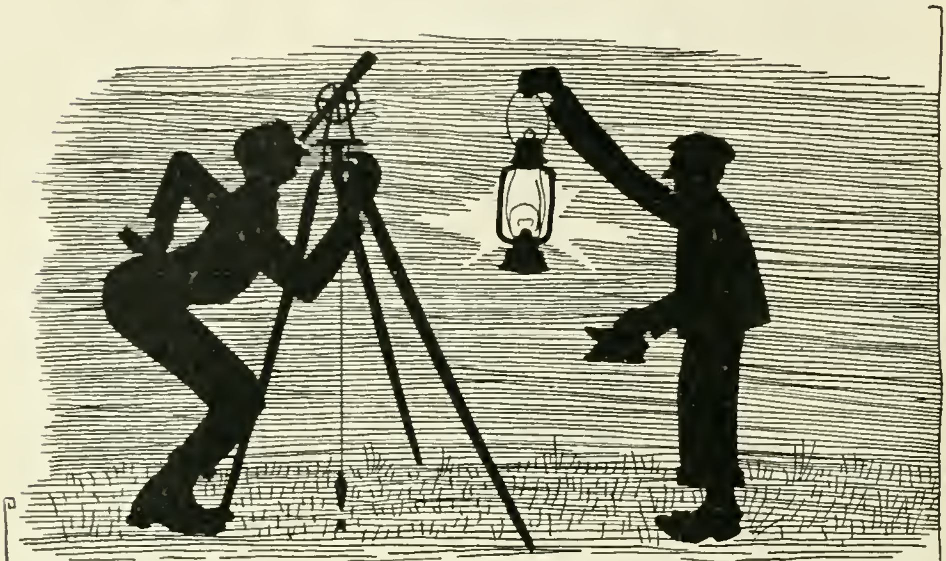
On account of the Fourth Term inaugurated in the Engineering Colleges for the benefit of men returning from the service, the annual summer surveying camp did not take place this year until the month of September. The camp was located at Sheldrake Springs on the west shore of the lake, about twenty-three miles north of Ithaca, the tents being erected on the grounds of the old Cayuga Lake House which burned about five years ago.

On August 28th, the campers embarked on the City of Ithaca which carried them up the lake to the camp site; and, before night, all tents were pitched and everything made ready for work to commence the following day. Assistant Professor P. H. Underwood was in charge of camp; the other members of the faculty who attended and their assignments were: Topography, Assistant Professors Conwell, L. C. Urquhart, Mr. J. E. Perry; Triangulation, Assistant Professor C. L. Walker; Hydrography, Assistant Professor L. A. Lawrence; Topographic Levels and Base Line, Mr. P. S. Wilson. Professor Underwood had charge of the Precise Level work.

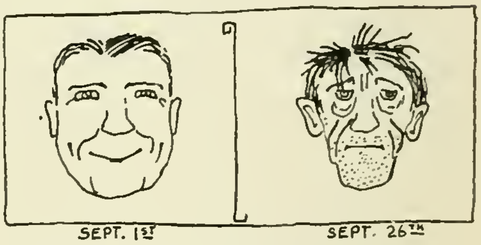
The officers of the camp were: W. A. Andrews, '19, Chief Engineer; T. C. McDermott, '19, Assistant Chief Engineer; C. E. Reese, '20, Quartermaster; Miss M. G. Arronet, '21, Commissary. Because of the war and the ensuing disintegration of class organization, "regular" sophomores were few and far between, and there were a number of men at camp from the classes of 1918, 1919, and 1920 as well as the 1921 class. There were about eighty students in all, including twelve foresters.

Assignments to plots and tents were made in the usual manner, drawing by lots, and the actual work started on August 29th. The original

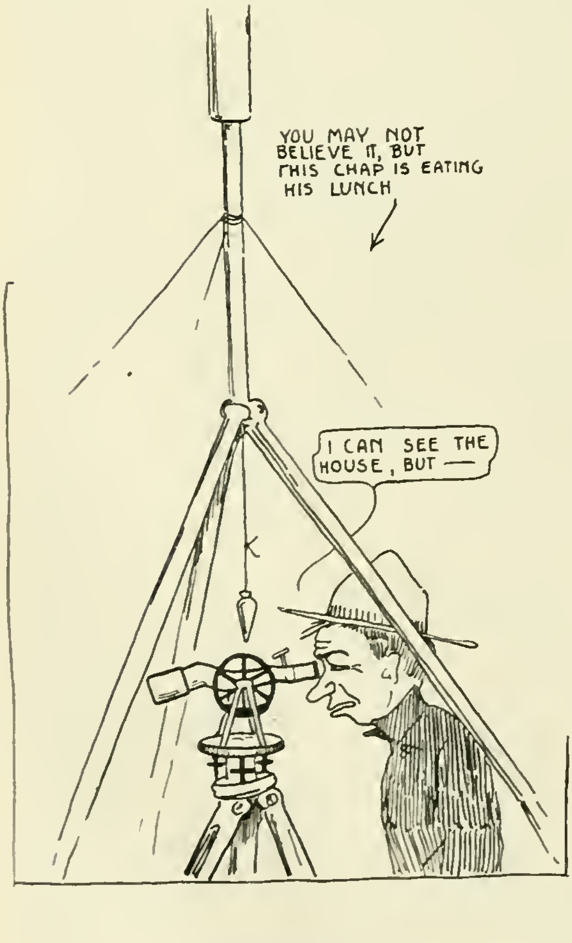
REMINISCENCES



NO, THESE LADS ARE NOT INSANE. THEY ARE MERELY VICTIMS OF THE CURRICULUM



HE'LL NEVER BE THE SAME SWEET BOY


YOU MAY NOT BELIEVE IT, BUT THIS CHAP IS EATING HIS LUNCH
I CAN SEE THE HOUSE, BUT —

THE FORESTERS WERE THERE TOO. —

Al. Herzig

NOW WHAR D'YE SUPPOSE ALL THEM STAKES COME FROM!
1 F 4

" I'M DREAMING DREAMS"
SUNITS

HYDROGRAPHY USED TO BE PRETTY INTERESTING —
AW KEEP THE BOAT STILL, WILL YA?
Al. Herzig

division of the plot to be surveyed consisted of fifteen plots, but as only fourteen parties were arranged, one of the plots was omitted. The survey extended about two miles on either side of camp, along the lake, and about four miles west, triangulation stations being placed along both shores of the lake and also further inland on each side. The base line was laid out about three miles west of camp on account of the fairly level road found there. For hydrography, Gus Alberger, '16, and his launch, the Utowanna, were engaged to carry the sextant operators up and down Cayuga's "waves of blue."

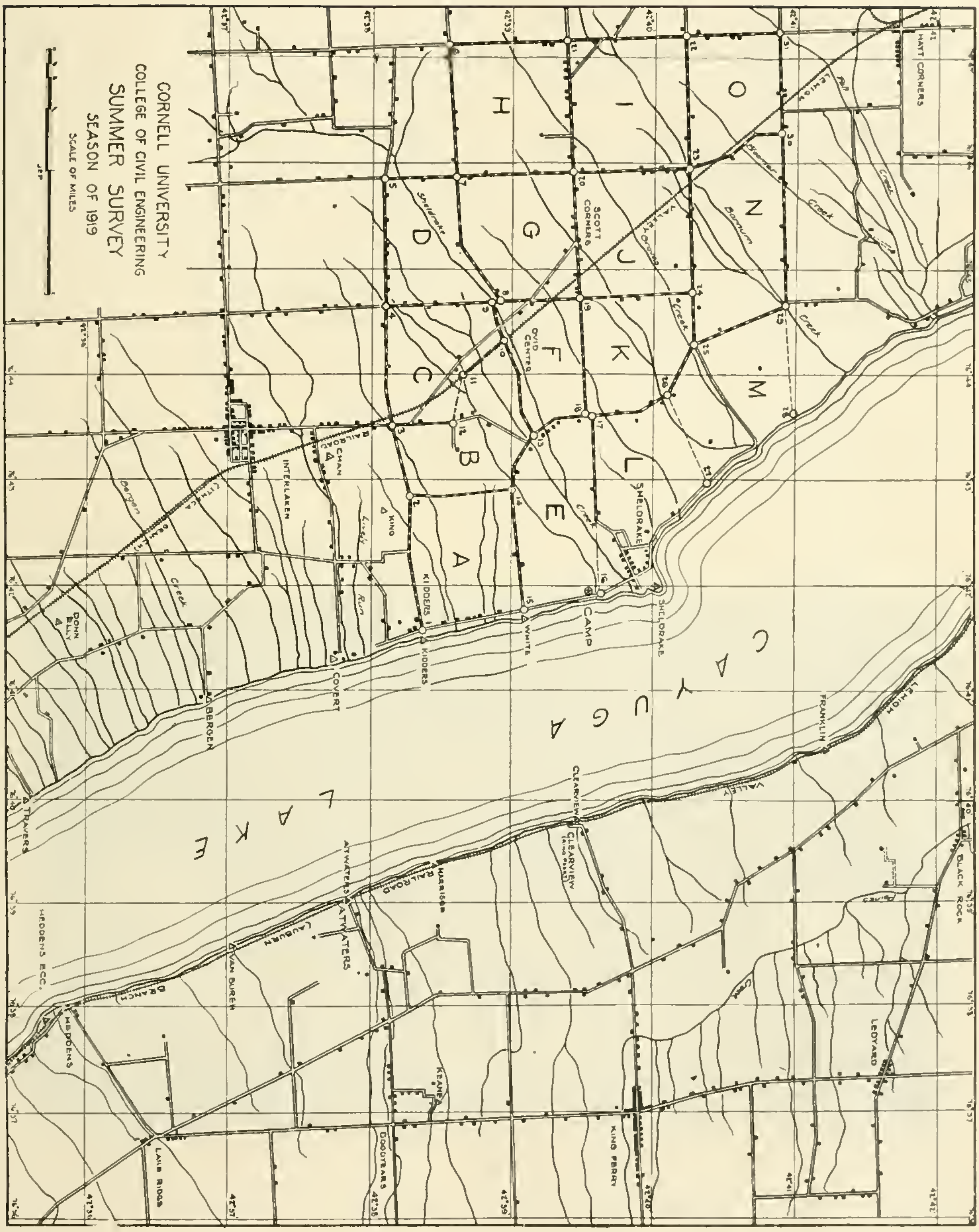
The evening of September third found many embryo astronomers in the fields behind the old hotel stable. There was much craning of necks, and many acrobatic features were performed before all had gained the necessary information from Arcturus and Polaris for determining the azimuth, time, and latitude. The acrobatics did not cease here however, as there were many, many logarithms to be juggled, and declinations and hour angles to be twisted into wierd shapes, before the work was over.

On September tenth, Professor Underwood took out the first precise level party; and on the twelth Mr. Wilson started reconaissance for establishing the base line. Measurement thereof was begun a few days later, and several records for speed in measuring the mile were hung up and broken at various times.

The summer in Ithaca had been quite rainy and cold and most of us looked for September to be a disagreeable month as far as weather was concerned. But the fates decreed differently and we were blest with fairly cool and bright days and delightful nights for sleeping purposes. The farmers were having a hard time ploughing the dry ground for their winter wheat, but surveyors could not have asked for better weather, the parties being forced to stay in only one-half day on account of rain. Professor Walker may take exception to this statement, because a haze hung over the lake most of the time and there were only a few days when the longer triangulation shots could be made at all.

Among the visitors at camp were: Dean and Mrs. Haskell, Prof. Leland, Prof. Jacoby, and a party of friends. Mrs. Lawrence, Mrs. Urquhart, and Mrs. Walker also called on us several times.

The night before camp broke up a very interesting party was arranged to celebrate the event; a barrel of cider was obtained from one of the nearby cider mills which had started operations, and some forty dozen doughnuts were sent up from Ithaca. We built a big fire down on the lake shore and spent the evening singing some of the good old songs and consuming vast quantities of the food and drink aforementioned. One of the chief entertainers at camp was Al Herzig, one of the foresters,


CORNELL UNIVERSITY
COLLEGE OF CIVIL ENGINEERING
SUMMER SURVEY
SEASON OF 1919
SCALE OF MILES
CAYUGA
LAKE
SHELDRAKE
CAMP
WHITE
KIDDERS
COVERT
BERGEN
TRAVERS
INTERLAKEN
OVID CENTER
SCOTT CORNERS
HAYT CORNERS
KING
DONN BILLY
FRANKLIN
CLEARVIEW
ATWATERS
HARRISON
VAN BUREN
HEDDENS
LEDYARD
BLACK ROCK
KING FERRY
KEANE
DOOOTEARS
LAIB RIDGE
Sheldrake Creek
Barnum Creek
Bergen Creek
Lively Run
LEHIGH VALLEY RAILROAD
A
B
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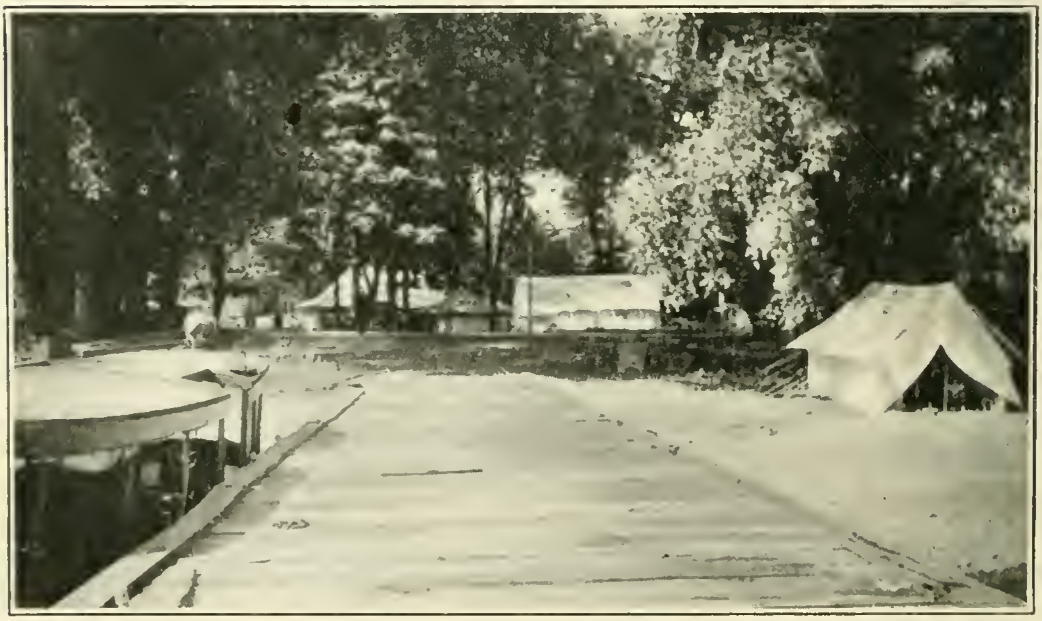
who is extremely clever with the pen, pencil or chalk. That evening he drew several pictures for us, and had a good "line" to go with them.

The good weather continued right up to the last minute making the breaking of camp a comparatively easy job; the old power house of the hotel was utilized as a store-room where a lot of the heavier equipment was placed for the winter. The steamer Horton carried the crowd to Ithaca and by three o'clock in the afternoon the last bit of canvas had been stored away under the roof of Lincoln Hall.

The 1919 camp might well be termed one of the most successful ever held. Although three days shorter than the previous camps have been, the same amount of work was accomplished and, due to the good weather, without the burning of several gallons of midnight oil.



PRACTICAL ENGLISH FOR TECHNICAL STUDENTS

Clark S. Northup, '93

I am well aware that what I have to say about the subject of English for technical students will seem to many readers of this journal to be anything but practical; nevertheless I have deliberately chosen this title to describe what, speaking of course as a layman (from the engineer's point of view) and as a general student of education, I believe to be one of the most practical courses a young engineer can pursue.

Let us first dwell for a moment on the word "practical." What do we mean by it? Etymologically it has connection with the *doing* of things. A practical spelling book is one that does not moon over the spelling of 1620 but helps us quickly and scientifically to learn the spelling of 1920. A practical house is one that is economical to build and run and convenient to get about in. A practical course of study is one that enables a student to accomplish a given thing with enough ease to make the course worth while for him.

Now we are all aware of how much the young engineer has to know in order to practice his profession intelligently and not make costly mistakes. The list of required subjects in any prescribed course in engineering is a long one; and every year pressure comes from various quarters to add other subjects to these lists. In the face of this pressure, does it not seem like an impertinence for a non-engineer to invade these pages—even at the request of one of the editors—and plead for the recognition of English as a practical subject worthy of a place in the curriculum of a college of engineering?

Nevertheless I shall venture to present some reasons why we should consider English a very practical subject. And the first is that his language is the most important tool that the engineer has to use. Whatever line of work he may take up, he will inevitably be concerned with the communication of his ideas to others—orders to workmen, specifications to builders and contractors, letters to all sorts of persons, lectures before societies, contributions to the technical and general press. And he will find that of all the tools he has to use, English is the hardest to learn to use well. A pump, located in given surroundings and driven by a given number of horse power, will do a definite amount of work; its maximum efficiency can be easily computed. The relative strength of certain types of bridges can be definitely ascertained. The variable human mind has nothing to do with these objective facts. But who can measure the power of words—"winged words," as Homer called them, which strike some, to speak figuratively, full in the face, and pass others by entirely or affect them no more than thistle down? How hardly do we arrive at the meaning of even some familiar sayings! In a recent class discussion the meaning of "A rolling stone gathers no moss" was sought. One man thought it meant that the rolling stone was by rolling prevented from getting coated over with moss, that is, mossbacked, and that it was a good thing for a stone to roll; it had never occurred to him to think of moss, in the sense meant by the maker of this proverb, as something worth having, something which the stone that rolled about thereby failed to acquire. Yet skill in the building of sentences is vastly harder to acquire than a knowledge of words. As Herbert Spencer pointed out, we may reason that for every idea there is one best order of words; how are we to find out what that order is? Many factors enter into the consideration—what we are trying to say, when and under what circumstances we wish to say it, the way our hearers are accustomed to have such things said to them, the sort of preparation our hearers have had for taking in the thought we seek to convey. No wonder it is hard to discover the one best way.

Yet the ambitious engineer is just as much bound to find that best way of "getting his thought over" as Beethoven was to find the best way of presenting the thought of his Fifth Symphony or Shakespeare was to seek the perfect expression of his thought in Hamlet. If the engineer succeeds it will be for precisely the same reasons for which they succeeded. And how great a handicap is slipshod, muddy, halting language!

We have all heard them—the men who had, we felt sure, some good ideas, but who halted and hesitated and hemmed and hawed and at last stammered out some words we knew were the wrong words, until we turned from them in disgust or pity at their failure. Again, how have we been thrilled by the man who had so ready a command of speech that he made the most abstruse subject as luminous as daylight, and in addition made us *feel* the tremendous importance of all that he had to say! Many a man with only a moderate equipment of knowledge but with high power of self-expression has talked or written himself into a position of influence—like the man who went to Washington ambitious to capture a captaincy and who after an hour's talk was made a major.

After graduating you go to New York to hunt for a job; or you write an application. You may be a veritable walking encyclopedia of facts about stresses and strains, and the composition of concrete, and so on; but how is the employer to learn all about that in a ten-minute interview or from a one-page letter? The fact is, if I am not mistaken, that beyond certain reasonable limits he does not care so much about the encyclopedia lurking in the back of your head as he does about your manner of dress and address, your way of carrying your learning, whether shallow or profound, your use of the linguistic tool, your proof that your mind has been trained to reason correctly, to take in orders and carry them out intelligently.

It would seem desirable, then, for the engineer, as well as for the lawyer and the minister, to learn how best to tell what he knows, and how to move his jury.

Another reason for the study of English by the engineer is that it makes more of a man of him. It gives him a background of knowledge and culture without which, however much he may know about bricks and mortar or oil and coal, he is only a trained artisan. It must be very delightful to be an engineer, and to have a sense of power over the forces of nature, and to harness those forces for the good of mankind. But who wants to be merely an engineer, and know nothing about the world except what will help us to build bridges or equip railroads? The engineer who knows only about other engineers and only about engineering enterprises is a rather dreary person to meet—as great a bore as the student of literature who can talk of nothing but Browning. But an educated man who knows something of the great movements of thought and feeling and who has some real interests outside of his chosen field of, say, bridge engineering, has a never-failing source of pleasure both to himself and to all who come into contact with him. And in reality he will be all the better bridge engineer for having, within reasonable limits, enlarged the scope of his outside interests. For he will be not merely an artisan who knows nothing else than his job, but a Man building bridges.

It is possible for an engineering student who has determination and will to use some leisure time in this way, to plan and carry out a useful course of reading in the English classics, and by careful observation of the style of what he reads, and with some practice in writing, to form an easy and effective style. There is no need of his taking a correspondence course. Let him start with George Herbert Palmer's "Self-Cultivation in English" (Houghton Mifflin Company) and a good book on English composition like Lamont's "English Composition" (Scribners); then go to the classics themselves, say in such series as the World's Classics (Oxford University Press), Everyman's Library (Dutton), or the Riverside Literature Series (Houghton Mifflin Comapny), and read in such directions as his inclination leads him—history, general science, biography, poetry, drama, fiction. He will soon discover what he likes best and may follow up that line with infinite profit and delight. All he has to do is to read thoughtfully and with a mind ready for comparisons, just as he would read an engineering treatise, and to keep at it systematically and resolutely.

But if the living teacher is better than one's own guidance, then it is desirable for the engineer to take one or more college courses in English. At the Massachusetts Institute of Technology (the catalogue of 1917–18 is the latest accessible) there is a freshman course of two hours required of all students; the first term is devoted to composition, the purpose being "to give the student training in expressing himself with accuracy and precision, and to teach him that the secret of clear writing is clear thinking," and the second term is given to the careful reading of essays by such writers as Huxley, Arnold, Ruskin, and Carlyle, leading the student to do exact, thoughtful reading and "to think about important problems of literature, science, and social life." There is likewise a required course of two hours a week for sophomores: in this the procedure of the freshman course is reversed and the reading is done in the first term. A few of the more important English authors are taken up, each at such length that the student gets a fairly clear view of the author's interpretation of life. In the second term there is composition designed to "give a power of thought and expression which will be useful both for general and for technical purposes." In certain courses there is also required work in English in the junior and senior years. The experience of the Institute and the standing of the Institute graduates seems to warrant and amply to justify this very moderate amount of attention to the study of English.

In closing, the writer may perhaps be permitted to express the earnest hope that in the reorganization of our technical courses of study which the new College of Engineering is to undertake, English may have the place to which it is entitled.[1] And in saying this I do not mean to imply that the student of engineering needs English more than does the student of arts. But I most certainly think he needs it just as much. The linguistic equipment represented by a mark of sixty in entrance English is too ridiculously poor to carry one through life. A three-hour year course in English should be required of *all* freshmen.

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[1] See also an article on "English for Technical Students" by the present writer in *The Sibley Journal of Engineering* for June, 1914, xxviii. 348–53; "The English Department and the Professional Schools," in the *Bulletin* of the Society for the Promotion of Engineering Education for October, 1916; Frank Aydelotte, English and Engineering, New York, McGraw-Hill Book Company, 1917; Homer A. Watt, The Composition of Technical Papers, New York, McGraw-Hill Book Company, 1917; and finally, Wilbur O. Sypherd, Bibliography on English for Engineers, Chicago, Scott, Foresman & Co., 1916.

A REVIEW OF RECENT ADVANCES IN THE LENGTH OF SPANS OF DIFFERENT CLASSES OF BRIDGES

By Henry S. Jacoby

Professor of Bridge Engineering in Cornell University

It is always interesting to notice the gradual increase in the length of spans for the different classes or types of bridges, as an indication of progress in bridge design and construction. This increase is the result of a number of factors: such as improvements in metallurgy and the manufacture of materials; better equipment in bridge works; improved methods and plant for erection; as well as experimental investigations and better designs of members and details of connections. Such improvements are materially stimulated when commercial needs require the use of a bridge that is larger and heavier than any other one of its class previously built. The advantages thus gained are shared later by structures of lesser magnitude.

In the accompanying table a list is given of the longest effective spans for different classes of bridges located on the North American continent. The dates in the last column show that 71 percent of these classes or types had their longest spans increased during the present decade, and of this number 73 percent were increased during the second half of the decade. The demand for the construction of so many bridges of unusual magnitude within this period could be required only by the transportation system of a prosperous country having large rivers to cross. It will be noticed that all but six in the list are railroad bridges.

Only two of the bridges were built in the nineteenth century. The stone arch bridge was practically displaced in the line of development by the concrete arch bridge many years ago, and hence it is unlikely that its span will be increased beyond the limit of 220 feet. The steel arch bridge at St. Louis, designed and built under the direction of Capt. James B. Eads, represented such an unprecedented advance at that time in its material, design, construction, erection, and cost, that it is not surprising that no larger span of its class has been built since. It may be added that only one steel arch bridge without hinges, with a span exceeding 200 feet, has been erected in this country since 1874, while the entire number of bridges of this type is very small in America.

The longest span for simple plate-girder bridges remained unchanged from 1904 to 1916, although much heavier plate girders were built during that interval. The longest single girder in the Boston & Albany R. R. bridge over the New York, New Haven & Hartford R. R. at Worcester, Mass., weighed 170 tons, and may be properly characterized as the most noteworthy, both in design and construction. Its length over all is 122 feet 6 inches.

The intermediate span of a steel viaduct taken by itself is not so characteristic of progress in viaduct construction as in other classes of bridges. The total lenght of the Lethbridge viaduct is 5327.6 feet, and its height 314 feet above the bed of the river. Other American viaducts with spans equal to or greater than 100 feet have a much shorter total length.

In 1907 the longest span of a simple truss bridge with riveted connections throughout, was 300 ft. 10 in.; in 1908 it was raised to 412 ft. 8 in., when the Canadian Pacific Ry. bridge over the French River was completed; in 1911 the span was raised to 425 ft. 6½ in., upon the completion of the Terminal R. R. bridge over the Missouri River at Kansas City, this being a double-deck bridge for double-track railroad traffic on the lower, and highway traffic on the upper deck. The next increase in span of over 50 per cent to the present value given in the table was due chiefly to unusual requirements for navigation, as finally determined by litigation which was going on while the rest of the bridge was under construction.

The increase in span for the simple truss bridge with pin connections is likewise remarkable. From 1894 to 1906 the longest span was 546 ft. 6 in., that of a bridge at Louisville, Ky., which accommodates a single-track railroad and a highway. In the latter years a light highway bridge was conmpleted at Elizabethtown, O., which brought the span up to 586 ft. Six years later another increase was made to 668 ft. by the erection of the Municipal or Free bridge at St. Louis, Mo., which is a double-deck structure with a double-track railroad on the lower floor. It was supposed that this span would remain the upper limit for a considerable time, but at least two years before the river spans of the Municipal bridge were completed, preliminary designs were begun for a bridge across the Ohio River at Metropolis, and which was completed seven years later, or in 1917. Its channel span of 720 ft. was made a simple truss in order to restrict its deflection under live load to lower limits than a cantilever span would permit.

The longest span of a plate-girder swing bridge was 196 ft. in 1900, 232 ft. in 1909, and was finally increased to 236 ft. as indicated in the table. It is a double-track bridge and could be designed of this length since it was fabricated at the shops of the Dominion Bridge Company, which are located within a few hundred feet of the bridge, thus avoiding the usual limitations due to transportation.

For 15 years the record span of 520 ft. for a swing bridge truss was held by the bridge over the Missouri River at East Omaha, Neb., completed in 1893. The one listed in the table has a span only one foot longer between centers of end bearings, and perhaps no further increase will be made on account of the operating advantages of bascule bridges, the largest of which (No. 10 in the table) provides a greater channel clearance than that of any swing bridge.

After the vertical lift bridge at South Halsted street, Chicago, was built in 1894, with a span of 130 ft., it was a long time until another one was constructed. This was due to the high cost of operation by steam which was the motive power required by the city, contrary to the recommendations of the engineer. When electric power was substituted in 1907, the results were so satisfactory that interest was renewed in the design of this class of bridges. In the bridge over the Misisissippi River at Keithsburg, Ill., the spans were made alike (229 ft.) and so arranged that the towers and lifting mechanism could be shifted from one span to another in case the channel in the river required it. Over thirty of these bridges have been built, most of them in the western states.

The longest span of 296 ft. given in the table is not that of the heaviest one, which is located at Portland, Ore., and which is a double-deck structure so arranged that the lower, or railroad deck, may be lifted first for low clearances, after which the entire span may be lifted for the higher clearances. Some idea of the lifting mechanism may be formed from the fact that each sheave weighs 24 tons and each of the four counterweights weighs 856 tons. The lift span in this case is only 211 ft. long.

In the vertical lift bridge at Kansas City given in the table, only the lower or suspended deck carrying a double-track railroad is lifted against the upper deck so as to provide for the limited clearance required. Before the construction of that bridge with its modern mechanism, only very short spans with a movable deck had been built.

Before the single-leaf bascule bridge given in the table was built the longest span was 235 ft., being that of the Baltimore & Ohio R. R. bridge over the Calumet River at South Chicago, completed in 1913. The double-leaf bascule bridge had its span increased from 275 ft. in 1901 to 336 ft. in 1914. The one included in the table is, however, entirely different in its action when closed than those previously built. It acts as a simple truss when closed while other double-leaf bascules act as two cantilevers locked together at the center. The development of bascule bridges in America is almost confined to the past score of years, but few examples of the modern type being in existence at the beginning of that period.

The Aerial Ferry bridge listed in the table is the only one of its kind in this country.

Until they were replaced in 1912–13 the 408-ft. spans of the Canadian Pacific Ry. bridge across the St. Lawrence River, near Montreal, had been the only statically indeterminate continuous trusses on the continent for a period of 25 years. Since the bridge which took its place consists of simple truss spans throughout, it seemed quite unlikely that any other continuous truss bridge would be built for a number of years. Favorable conditions, however, led to the construction of a continuous truss bridge consisting of two spans each 775 ft. long, over the Ohio River, at Sciotoville, as indicated in the table. It was more surprising to find that two others were also under construction in 1917 and were completed during the following year, one over Nelson River on the Hudson Bay Ry., and the other over the Allegheny River on the Bessemer & Lake Erie R. R., their largest spans being 400 ft. and 520 ft. ½ in., respectively.

The record span for cantilever bridges in America had been held by the Memphis bridge, completed in 1892; then by the Monongahela River bridge at Pittsburgh, finished in 1904; and then by the Queensboro bridge at Blackwell's Island, New York, from 1909 until the Quebec bridge was built. The cantilever spans of these three bridges were 790 ft. 5 in., 812 ft., and 1,182 ft. respectively.

Before the longest suspension bridge span given in the table was erected, the record was held continuously at 1,595 ft. 6 in. by the world-famous Brooklyn bridge ever since its completion in 1883. This bridge was also noted for many years as having the largest passenger traffic of any bridge, of any class, in the world.

In the class of steel arches and of the three-hinged type, the longest span (456 ft.) was in the Marshall Avenue bridge at Minneapolis, Minn., from 1889 to 1905; then it was increased to 540 ft. in the Connecticut River highway bridge at Rockingham, Vt.; the next increase to 591 ft. being made in 1915 when the Detroit-Superior bridge in Cleveland, O., was finished. This last bridge is a double-deck structure consisting of reinforced-concrete arches, with the exception of the single long span mentioned. This span represents the highest development of the three-hinged steel arch bridge although the light highway bridge given in the table as No. 15, completed a year later, has a span one foot longer.

The longest span of any two-hinged steel arch bridge before the erection of the Hell Gate bridge listed in the table was 840 feet, being that of the upper arch bridge at Niagara Falls, completed in 1898. For one year the record had been held previously by the 550-ft. span of the lower arch bridge over the Niagara River, which is a double-deck bridge with the Grand Trunk R. R. on the top floor.

Before the famous Eads arch bridge at St. Louis was built to which reference was made previously in this paper, the longest span of any steel arch bridge without hinges located in America was only 200 ft., it being that of an interesting bridge on Pennsylvania avenue, in Washington, D. C., which was built in 1858 and replaced in 1916. Its arch ribs consisted of cast-iron pipes which conveyed a water supply across Rock Creek, while the deck of the structure carried ordinary highway traffic.

The term "plain concrete arch" as used in the table refers to one in which no steel is used to aid the concrete in the arch rib to resist dead or live load stresses, but in which a small amount of steel may be used for the prevention of cracks due to temperature. From 1907 to 1910 the longest clear span in a concrete arch bridge of this type was 233 ft., being that of the Walnut Lane bridge in Fairmount Park, Philadelphia. In 1910 the record passed to the bridge over Rocky River near Cleveland, O., its span being 280 feet, and a year later to the one given in the table as No. 19.

In 1912 a reinforced-concrete arch bridge was completed in this country with a larger span that that mentioned in the preceding paragraph. It was the Larimer avenue bridge in Pittsburgh, Pa., with a clear span of 300 ft. 4⅞ in. A design has been made for a 400-ft. span which is to be the channel span of a bridge across the Mississippi River at Franklin avenue, Minneapolis, Minn. The bridge is now under construction.

LONGEST SPANS FOR DIFFERENT CLASSES OF AMERICAN BRIDGES

No.	Class of bridge	Span Ft.	Span In.	Location	Date of Completion.
1	Simple Plate Girder	130	6½	Grand Crossing, Ill.; Nickel Plate R.R.	1916
2	Steel Viaduct	100	0	Lethbridge, Alberta; Canadian Pacific Railway	1909
3	Simple Truss, Riveted	643	10½	Louisville, Ky.; Pennsylvania Lines	1919
4	Simple Truss, Pin	720	0	Metropolis, Ill.; C. B. & Q., and N. C. & St. L. Ry.	1917
5	Swing, Plate Girder	236	0	Over Lachine Canal, n., Montreal; Can. Pac. Ry.	1915
6	Swing, Truss	521	0	Portland, Ore.; Northern Pacific Ry.	1908
7	Vertical Lift	296	0	N. Mondak, Mon.; Great North. Ry.	1914
8	Vertical Lift (floor only)	428	0	Kansas City, Mo.; Terminal R. R.	1911
9	Bascule, Single Leaf	260	0	Chicago, Ill.; St. Charles Air Line Ry.	1919
10	Bascule, Double Leaf	336	0	Sault Ste. Marie; Canadian Pac. Ry.	1914
11	Aerial Ferry	393	9	Duluth, Minn.; over U. S. Ship Canal	1905
12	Continuous Truss	775	0	Sciotoville, O.; Chesapeake & Ohio Northern R. R.	1917
13	Cantilever	1800	0	n. Quebec Canada; Grand Trunk R.R	1917
14	Suspension	1600	0	N. Y. City; Williamsburgh Bridge	1904
15	Steel Arch—3 Hinged	592	0	Needles, Calif.; Highway over Colorado River	1916
16	Steel Arch—2 Hinged	977	6	Hell Gate, N. Y. City; N. Y. Connecting R. R	1917
17	Steel Arch—No Hinged	519	9⅜	St. Louis, Mo.; Pennsylvania Lines	1874
18	Stone Arch	220	0	n. Washington, D. C., Aqueduct bridge	1864
19	Plain Concrete Arch	281	0	Monroe St., Spokane, Wash	1911
20	Reinforced-Concrete Arch	300	4⅞	Larimer Ave., Pittsburgh, Pa.	1912
21	Concrete Viaduct	180	0	Nicholson, Pa., Lackawanna R. R.	1915

The statement made regarding steel viaducts applies likewise to reinforced-concrete viaducts. The Tunkhannock viaduct (No. 21 in the table) is a double-track structure, has a total length of 2,230 ft., contains 164,000 cu. yd. of concrete and 1,140 tons of reinforcing steel, while the top of the track rail is 240 ft. above the bed of Tunkhannock Creek. Other concrete viaducts of lighter construction are much longer from end to end, while still others may have a larger span but none of them approach this one in mass.

It may be interesting to add a paragraph on those bridges in other lands which have larger spans than any bridges in America belonging to the same class. There are longer simple plate girders than those in America, but they are of much lighter construction. The published records are not complete enough to identify the one which has the maximum span. There are transporter bridges in England, France, and other European countries having a movable car but the longest span of approximately a thousand feet uses a light suspension bridge to support the track instead of a simple truss bridge as in No. 11 of the table. The longest span of any steel arch bridge without hinges crosses the Wupper River between Remscheid and Solingen in Germany. Its span is 558 ft., and the bridge was completed in 1897. The longest clear span of any stone arch bridge in the world is 295.3 ft. It is located at Plauen in Saxony and was finished in 1905. The longest clear span of any reinforced-concrete arch bridge in the world is 328.1 ft., being that of a very light highway bridge across the River Tiber at Rome, Italy, completed in 1911. There are two other bridges of the same class with longer spans than the Larimer avenue bridge in Pittsburgh: one is located at Grafton, Auckland, New Zealand, with a span of 320 ft.; and the other at Langwiez, Switzerland, with a span of 314.9 ft.; their years of completion being 1910 and 1913, respectively.

The adoption of alloy steels, after thorough chemical and physical investigations, has had an important part in the economic construction of some of the long-span bridges included in the table. Nickel steel was the first to be introduced and has been used in the Queensboro cantilever and the Manhattan suspension bridges at New York, the Terminal Railroad bridge at Kansas City, the Municipal bridge at St. Louis, the Quebec cantilever bridge, the Detroit-Superior arch bridge at Cleveland, and in the eyebars of the Metropolis bridge. High-carbon steel was employed in the Hell Gate arch bridge and in the continuous truss bridge at Sciotoville. Steel high in silicon was adopted for the riveted members of the Metropolis bridge; Mayari steel, a low-grade natural alloy with nickel and chromium was used for the Harahan cantilever bridge at Memphis; and a special steel was employed for the continuous truss bridge of the Bessemer & Lake Erie R. R., the characteristics of which have not been published.

It is a very remarkable fact that several of the bridges of great magnitude which are mentioned in this paper were under construction at the same time. In this group are included the longest simple truss span, the longest continuous truss span, the longest cantilever span, and the longest steel arch span; all of them being the longest spans in the world in their respective classes. An inspection of the table will indicate that the longest spans in several other classes were also completed during the period of construction of the greater structures named.

At the same time that the lengths of span have been steadily increasing, and the alloy steels have come into use, the live loads specified have also continued to increase. For a decade E60 loading has been adopted for important railroad bridges, but recently this has been exceeded in several cases. In designing the Metropolis bridge, the specified live load consisted of E90 locomotives followed by an E75 train, but the working unit-stresses were also raised above the usual values; however, in the case of the Bessemer and Lake Erie R. R. continuous truss bridge, the live load was Cooper's E75 loading while relatively low unit-stresses were adopted.

The statement made in the last sentence of the first paragraph of this paper received an unexpected confirmation about a week after it was written when the long-delayed issue of *Engineering News-Record* for October 2, 1919 was received. It contains an article on "Unusual Design and Joint Details of a 430-Foot Bridge." In this case built-up members of high-carbon steel were used in conjunction with heat-treated eye-bars for the end diagonals and lower chord members, requiring special joint details at the lower chord pins. A Warren type of truss with sub-verticals and a curved upper chord was adopted, it being possible to avoid sub-divided panels by using panels 43 feet long, with deep stringers, and floor-beams. Expansion joints are provided in the steel floor system by double floor-beams at two intermediate panel points and in each panel of the solid reinforced-concrete ballasted double-track floor. Skid girders are also provided like those introduced in 1910 on the Pittsburgh & Lake Erie R. R. cantilever bridge at Beaver, Pa.

THE VALUE OF A HYDRAULIC HORSEPOWER AT THE WHEEL

E. W. Rettger, Ph. D.*

In an article entitled "Economical Size of Pipe for a Given Loss of Head" (see CORNELL CIVIL ENGINEER, p. 83, April, 1919; reprinted in *The Canadian Engineer*, p. 148, Vol. 37, July 17, 1919) the writer solved the following problem:

Given a pipe of fixed length, l, and under a given head, h, with a given discharge, q, it is required to find the size of the pipe so that for a given or assumed total loss of head, h', due to friction in the pipe the annual cost of the pipe (or the first cost, or the amount of metal as the case may be) will be a minimum.

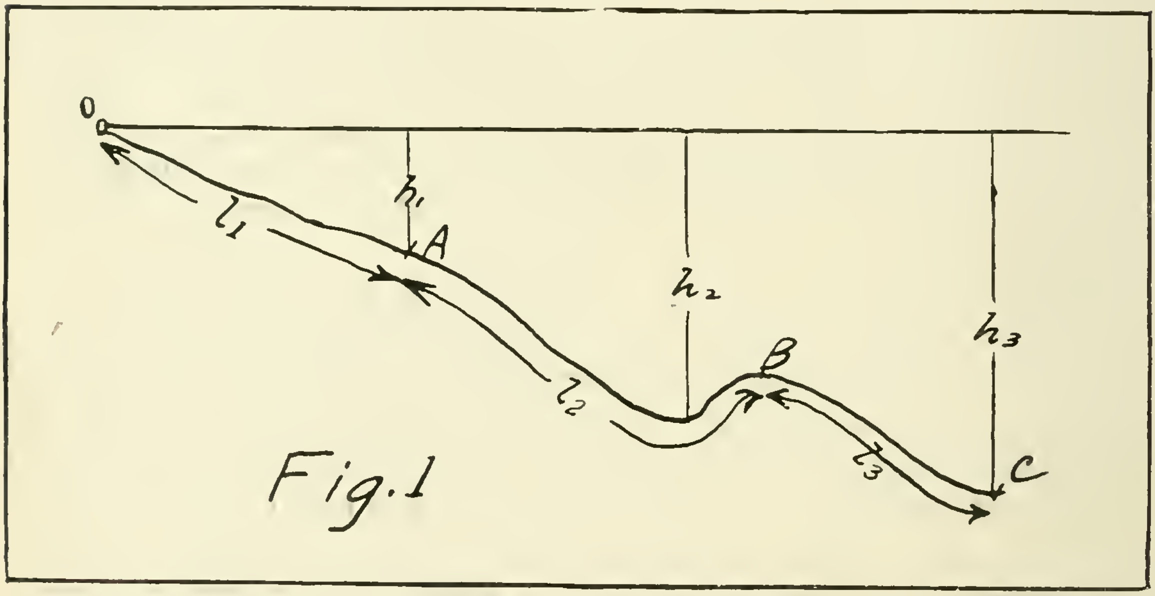

Fig. 1

If the pipe has a uniform diameter thruout, the problem is comparatively easy. The writer has special reference therefore, to a pipe under high head where it is desired to make this pipe consist of two or more sections of different diameters and different thickness of shell. Theoretically, the most economical pipe is one in which the diameter decreases as the head increases. In practice, however, the pipe is made to consist of two or more sections, each section of constant diameter and thickness of shell. The greater the number of sections, the nearer will the pipe approach the theoretically most economical pipe.

For convenience, the pipe was assumed to consist of three sections OA, AB and BC, of lengths l_1, l_2, and l_3, respectively. The highest heads the respective sections are under are h_1, h_2, and h_3 (see Fig. 1).

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Evidently, the location of the points of division, A and B, will affect the economy. No general solution can be given which will determine the position of the most economical points of division. These points can best be determined perhaps by trial. It was assumed therefore that the location of the points that divide the pipe into sections were known. These points need not be the most economical points. Consequently, l_1, l_2, and l_3 and h_1, h_2, and h_3 were all assumed as known. That is, it was assumed that the length of each section and the highest head it was under were given, and it was required to find the diameters of these sections so that the pipe as a whole would entail the minimum annual cost or minimum first cost, or would contain the minimum amount of metal as the case may be, subject to the condition that the total loss of head in the pipe due to friction should equal h′.

FORMULAS

For riveted steel pipes, the writer found that the solution of the problem was given by the following equations:

$$(1) \quad d = 0.2195\sqrt[6]{\frac{f\,b\,q^3}{t'\,c\,i}}$$

applicable to a section under low head, and

$$(2) \quad d = 0.2153\sqrt[7]{\frac{f\,b\,q^3\,S}{c\,i\,h}}$$

applicable to a section under high head.

In these equations, *f* is the coefficient of friction as given by the equation $h' = \frac{f\,l}{d} \cdot \frac{v^2}{2g}$; *S* is the allowable unit stress in shell in pounds per square inch, corrected for rivet holes and water hammer; *c* is the cost of the metal per pound; *i* is the rate of interest and depreciation on first cost of pipe; *q* is the discharge in cubic feet per second; *h* is the highest head the section under consideration is under; t' is the minimum allowable thickness of shell; and *b* is a parameter to be determined.

In the article cited above, the writer showed how the value of the parameter *b* can be found for any case, and he pointed out that in most cases the simplest method of procedure was as follows: assume a value for the parameter, *b*, and determine the diameters of the several sections of the pipe by means of equations (1) and (2). The total loss of head due to friction in this pipe can then be found. If this equals *h′*, the amount specified, the problem is solved. If not, other values for *b* should be successively assumed until the pipe is found for which the total loss of head is *h′*.

Equations (1) and (2) contain f, the coefficient of friction, which is not known to start with. To eliminate this unknown f, the writer developed the following equations:

$$(1')\quad d = 0.1356\sqrt[6.25]{\frac{b\,q^3}{t'\,c\,i}}\qquad \text{for low head}$$

and

$$(2')\quad d = 0.1423\sqrt[7.25]{\frac{b\,q^3\,S}{c\,i\,h}}\qquad \text{for high head.}$$

In many cases the saving in the amount of metal required if the pipe under high head is designed for several sections of different diameters and thickness of shell over that required if these sections are designed all for the same diameter, but for different thickness of shell, is hardly enough to justify the expense of the reducers. The writer, therefore, developed a formula for a pipe under high head (or part of the pipe), if all the sections shall have the same diameter but different thickness of shell. He discovered that formula (2), or (2′) is applicable if for h in this formula we put h_c, where

$$h_c = \frac{h_1 l_1 + h_2 l_2 + h_3 l_3}{l_1 + l_2 + l_3}$$

in which h_1, h_2, h_3 and l_1, l_2, l_3 have the same meaning as above (See Fig. 1).

Formulas (1) and (2) [or (1′) and (2′)] determine the economical pipe for the least annual cost. If $i = 1$, they will determine the pipe for least first cost; and if $c = i = 1$, they will determine the pipe of least amount of metal. These formulas hold only for riveted steel pipes, homogeneous thruout, and for such pipes the pipe of least amount of metal will be the pipe of least first cost or least annual cost. Formulas similar to the above can be derived, however, for each kind of pipe, and if a section of the pipe (say the upper) is made of different material from that of the other sections, the appropriate formula must be applied to that section. It is not a question now of least amount of metal but rather one of least first cost, or least annual cost.

Formulas (1) and (2) [or (1′) and (2′)] may be used to solve a variety of problems. Suppose for instance it is required to find the pipe for which the percentage return on original investment shall equal a specified amount. To find this pipe, assume values for b successively and for each assumed value for b determine the pipe and calculate the percentage return, p, on original investment. A curve may then be plotted with b as abscissa and p as ordinate. From this curve that value of b can be obtained that will determine the economical pipe for which the percentage return is the amount specified.

SAME AS FORMULAS DERIVED FROM ADAMS' RULE

An examination of formulas (1) and (2) will show that they are the same as the formulas derived for the economical size of a pipe (riveted steel) from the point of view of Adams' Rule. This rule may be expressed as follows,—*That pipe is most economically designed for which the interest and depreciation on first cost of pipe plus the annual value of the power lost due to friction in the pipe is a minimum.*

For convenience we will again assume that the pipe is to consist of three sections as shown in Fig. 1. The points of division, A and B, are assumed as given. Let I_1, I_2 and I_3 be the interest and depreciation on the first cost of the respective sections. Then $I = I_1 + I_2 + I_3$ is the interest and depreciation on first cost of the pipe as a whole. Let h'_1, h'_2 and h'_3 be the losses due to friction in the respective sections so that the total loss is

$$h' = h'_1 + h'_2 + h'_3$$

Also, let B_1, B_2 and B_3 be the values of the power lost in the respective sections so that the total loss is

$$B = B_1 + B_2 + B_3$$

The power lost in the pipe is then

$$P = \frac{62.5\, q\, h'}{550} = \frac{q\, h'}{8.8}$$

and the value of the power lost is

$$B = bP = b\,\frac{qh'}{8.8} = \frac{bq}{8.8}\,(h'_1 + h'_2 + h'_3) = B_1 + B_2 + B_3$$

where *b* is the annual value of a hydraulic horsepower at the wheel. If we let

$$(4)\quad L = I + B = I + b\,\frac{qh'}{8.8}$$

$$= (I_1 + B_1) + (I_2 + B_2) + (I_3 + B_3) = L_1 + L_2 + L_3$$

where

$$(5)\quad L_1 = I_1 + B_1 = I_1 + b\,\frac{qh'_1}{8.8}$$

and similarly for L_2 and L_3, then according to Adams' Rule L must be a minimum. Now L is a function of d_1, d_2, and d_3, and for L to be a minimum the partial derivations of L with respect to d_1, d_2 and d_3 must separately be equal to zero, that is, we must have

$$\frac{dL}{d(d_1)} = \frac{dL}{d(d_2)} = \frac{dL}{d(d_3)} = 0$$

Now L_1 contains d_1 as the only variable (see eq. 5). In like manner L_2 and L_3 contain d_2 and d_3 respectively as the only variables. Therefore (see eq. 4)

$$\frac{dL}{d\,(d_1)} = \frac{dL_1}{d\,(d_1)}$$

and similarly for L_2 and L_3. The conditions that must be satisfied then for L to be a minimum are

$$\frac{dL_1}{d\,(d_1)} = 0, \frac{dL_2}{d\,(d_2)} = 0, \frac{dL_3}{d\,(d_3)} = 0.$$

Or, in general, if the subscript r is used to designate any section (see eq. 5)

$$(6) \quad \frac{dL_r}{d(d_r)} = \frac{d\,I_r}{d\,(d_r)} + b\,\frac{q \times dh'_r}{8.8 \times d\,(d_r)} = 0.$$

for each section of the pipe.

Equation (6) leads to the formulas (1) and (2), or (1′) and (2′). (See article by the writer cited above. Also see Meads' Water Power Engineering, 2d Edition, Page 546 where formulas (1) and (2) are derived by taking sections one foot long).

Formulas (1) and (2) contain *b*, the value of a hydraulic horsepower at the wheel. Nowehere so far as the writer knows is it shown just what should be taken for the value of a hydraulic horsepower at the wheel. Several interpretations may be given to *b*, and for these interpretations the results will be different. The writer therefore decided to determine for himself just what will be accomplished for each of several interpretations that may be given to *b*.

I. The first and most general interpretation for *b* has already been indicated in the first part of this article, namely, *b may be taken as a constant or a parameter such that for every assumed value for b, formulas (1) and (2) will determine that pipe which for the resulting loss of head in the pipe will be the pipe of least annual cost or least first cost in least amount of metal as the case may be.*

SOME OF THE INTERPRETATIONS THAT MAY BE GIVEN TO *b*, INTERPRETED AS THE ANNUAL VALUE OF A HYDRAULIC HORSEPOWER AT THE WHEEL

Let *C* equal the annual cost of everything down to the end of the pipe line but not including the pipe itself, and let *K* equal the annual cost of everything from end of pipe line on. In discussions of this kind it is usually assumed that the variation in the values of *C* and *K* due to a small variation in the value of the diameter *d* of the pipe is negligible when compared with the corresponding variation in the value of L = I + B. That is, it will be assumed that $\frac{dC}{d\,(d)} = 0$ and $\frac{dK}{d\,(d)} = 0$ when compared with $\frac{dL.}{d\,(d)}$.

II. *If b be taken as the annual commercial value of a hydraulic horse power at the wheel, these formulas will determine that pipe for which the annual net profits on the part of the plant that includes everything from dam to end of pipe line will be a maximum.* These profits are over and above all annual expenses including the interest and depreciation on first cost of pipe.

Note. If one company owned the part from dam to end of pipe line and if it sold its hydraulic power to a second company the first company would be interested only in the profits derived from the part it owned.

The proof is as follows: The total net annual profits on the part from dam to end of pipe line are given by

$$b\frac{q\,(h - h')}{8.8} - (I + C)$$

since the available hydraulic horsepower at the end of the pipe line is $\dfrac{62.5\,q\,(h - h')}{550} = \dfrac{q\,(h - h')}{8.8}$.

In the above expression, *C* is the annual cost of this part of the plant not included in I, and I is the interest and depreciation on the first cost of pipe.

Rearranging terms, the above expression may be written in the form $\dfrac{b\,q\,h}{8.8} - C - \left[I + \dfrac{b\,q\,h'}{8.8}\right]$.

This last expression will be a maximum if the quantity in brackets, that is, if *L*, is a minimum [See equation (4)]. Minimizing *L* leads to formulas (1) and (2). The proposition, therefore, has been proved.

III. *If b be taken as the annual cost of producing a hydraulic horsepower at the wheel, this cost being based only on the annual cost of everything from dam to end of pipe line, these formulas will determine that pipe for which this cost will be a minimum* (see Note above).

If, for convenience, we again assume that the pipe consists of three sections, *b* may be expressed by

$$(7)\quad b = \frac{I_1 + I_2 + I_3 + C}{q_1\left(\dfrac{h - h_1' - h_2' - h_3'}{8.8}\right)}$$

where *C* may be thought of as a constant since $\dfrac{dC}{d\,(d)}$ is negligible compared with $\dfrac{dI}{d\,(d)}$. Now *b* is a function of d_1, d_2, and d_3, and for *b* to be a minimum the partial derivatives of *b* with respect to d_1, d_2 and d_3 must separately be equal to zero. Remembering that d_1 is contained only in I_1 and h_1', $\frac{d\,b}{d\,(d_1)} =$

$$\frac{q\left(\frac{h - h_1' - h_2' - h_3'}{8.8}\right)\frac{d\,I}{d\,(d_1)} + (I_1 + I_2 + I_3 + C) . \frac{q}{8.8} . \frac{dh_1'}{d\,(d_1)}}{\left[q\,\frac{h - h_1' - h_2' - h_3'}{8.8}\right]^2} = 0.$$

Simplifying and making use of equation (7), we obtain

$$\frac{d\,I_1}{d\,(d_1)} + \frac{b\,q}{8.8}\,\frac{d\,h_1'}{d\,(d_1)} = 0,$$

and similarly for the other sections. That is, we must have

$$\frac{d\,L_r}{d\,(d_r)} = \frac{d\,I_r}{d\,(d_r)} + \frac{b\,q}{8.8}\,\frac{d\,h_r'}{d\,(d_r)} = 0$$

for each section of the pipe. This last equation is the same as equation (6) from which the formulas were derived. The proposition, therefore, has been proved.

IV. *Let m be the annual commercial value of electric power (per horsepower) and let γ be the efficiency of plant from end of pipe line on, then, if $b = \gamma m$, these formulas will determine that pipe for which the total net annual profits on entire plant over and above all annual cost will be a maximum.*

The total net annual profits on entire plant are

$$m.\gamma\,\frac{q\,(h - h')}{8.8} - I + (C + K)$$

where K is the annual cost of everything from end of pipe line on, assumed as practically constant when compared with I.

Putting $b = \gamma m$ and rearranging terms, this expression may be written

$$\frac{b\,q\,h}{8.8} - C - K - \left[I + \frac{b\,q\,h'}{8.8}\right]$$

This will be a maximum when the quantity in brackets, that is, when L for the whole pipe is a minimum. The proposition therefore has been proved.

V. *If b be taken as the total annual cost per hydraulic horsepower developed at the wheel (that is, as the annual cost of the entire plant per hydraulic horsepower developed at the wheel), these formulas will determine that pipe for which this cost is a minimum.*

That is,

$$b = \frac{I_1 + I_2 + I_3 + C + K}{q\left(\frac{h - h_1' - h_2' - h_3'}{8.8}\right)}$$

Proceeding as we did in III, it will be found that $\frac{d\ L_r}{d\ (d_r)} = 0$ for each section of the pipe. The proposition, therefore, has been proved.

The above five interpretations are not necessarily the only interpretations that may be given to the quantity *b* found in the standard formulas for the economical design of penstocks or pipes. The writer hopes, however, that the interpretations here given may be of some interest to students of hydraulics.

With the ever-increasing additions to the present great store of technical knowledge, I have no hesitancy in expressing my belief that the institutions that are in the lead with a five or six-year technical course will readily find better positions for their graduates than will the others. It certainly appears reasonable that in an institution having well-equipped laboratories and a corps of competent instructors, it is possible for the student during the one or two extra years to do much more for himself than would be possible in the same time after leaving at the end of a four-year course with what amounts to a too hastily swallowed dose of everything taken; this is evidenced not infrequently by cases of acute mental indigestion and, as complained of by the manufacturers, and utter lack of originality, judgment, or logic in meeting shop requirements.

—SCOTT.

The effect of great bridges upon thoughtful observers, outside of the ranks of the engineering profession, is well illustrated by a remark included by President Hibben of Princeton University in his address of welcome to the Society for the Promotion of Engineering Education at its annual meeting in 1914. He said: "I look upon the engineering profession with a great deal of pride for what it has accomplished, particularly within the last generation. This sentiment I shared with Mr. Grover Cleveland who, when a resident at Princeton said to me, in referring to his young son, "I would rather see that boy become a man able to build a great bridge than anything else in the world." This man of affairs, this great administrator and statesman, desired for his boy the ability which you, as engineers, possess."

SELLING YOUR OWN SERVICE

C. S. Rindsfoos, '05

It has been said that the hardest thing in the world to sell is service. This may be true but it is equally true that very few men—certainly very few young men realize the need of this ability to sell their own service. This is surprising when we consider that every man who works has found it necessary at one time or another to sell his own ability. The laborer and mechanic have formed labor unions for no other purpose than to market their work to better advantage. Why is it that the educated man has thought so little about how best to market his talents? With libraries containing hundreds of books on salesmanship, why is it that most men, even professional salesmen themselves, spend so little time in the study or practice of the art of selling their own time?

Of course the answer appears to be that most men sell their service but a few times even in the course of a life time, and at first blush it would seem unnecessary to devote much effort to the learning of an art that is to be practised so seldom. The fact is, however, that we are all selling our service every day in the year—not only when we engage in a new position but every day thereafter. Every thing we do, every person we meet, every point of contact we make with another individual causes that other individual to unconsciously take our measure and appraise our worth. Two men may start with the same employer at the same rate of pay and both may do equally good work. Both may have equally pleasing personalities and equal opportunities to make good. One will advance faster than the other if he sells himself every day, i. e. if he consciously and systematically presents the fruits of his labor in attractive and marketable shape.

Personally, I blame the colleges for the failure of their graduates to realize this. This is particularly true of Engineering Colleges which teach their students how to design bridges, dams and railroads, but nary a principle governing how to sell this ability—how to get the opportunity to apply this knowledge—how to get a job. To my mind it is as inexcusable as filling a man's head full of the theory of navigation and then putting him adrift in a small boat with neither oars nor compass.

My work during the past year in connection with the Registration Bureau has impressed me with the lack of knowledge which our graduates possess when it comes to obtaining a position. Indeed, some of the mistakes which are made almost seem calculated to defeat the object sought to be attained, so that a few simple rules may not be out of place. Some of these rules seem elementary but they are no less important.

1. *Always call in person when possible.* I have known men living in New York City, who, after being notified of an opening also in New York, would calmly sit themselves down and write a letter instead of taking the trouble to call in person. Remember—good positions no less than big deals are not put over by letter.

2. *Write a good letter.* Often it is necessary to write, especially to open negotiations. In such cases write the best letter that it is in you to compose. Draft it in pencil and work over it. If you do not write a good hand have the letter typed. Make it short and concise. If it is necessary to file your experience do this on a separate sheet. Put "heart interest" into it (as the publicity men say) but don't tell your family history. Imagine you are designing an advertisement in that the composition be so arranged and contain such matter that it:
    a. catches the reader's interest
    b. holds his attention while reading
    c. creates a desire to see you or employ you.

   Space does not permit elaborating these principles but many good books are available.

3. *Be prompt.* Remember there are other good men who will be candidates for the same position and the man of energy will not delay.

4. *Study your prospect.* If there is an opening for a man to build a dam and you have had experience building both dams and buildings, lay stress on your experience in dam building—that is, the task in which your prospect is interested. If your prospective employer is a Cornell man, let him know that you are also but don't "rub it in." If you have anything in common, fraternal, social or what not, let it be known, for it identifies you in his mind, but do not depend on that alone to put you over. Try to find out all you can of your prospect's connections before you go to see him. There is usually a way. Try to size up his type when you meet him and stress the points you think will appeal to him. Books which treat of character reading are helpful. Don't try to talk baseball to a thin lipped, dried-up, theoretical type. Don't talk theory to a red faced, meat eating, general superintendent.

5. *Don't tell everything you know.* You may find it necessary to have a second interview. Hold something in reserve. More people lose by saying the wrong thing than by not saying enough.

6. *Have confidence in yourself.* If you don't believe you can hold down the job, how do you expect your employer to believe so? What you say is not so important as how you say it. Speak with conviction. Cornell wins more crew races than football games because habit is strong.
7. *Set your price high.* You will never get more than you ask for. It is easier to drop your price than to raise it. It is better to wait a month longer and get a higher rate of pay. A month's loss of wages spread out over a year and divided by twelve does not look so large. A man who walks in and says he is a ten thousand dollar man looks bigger than the same man at five thousand. Of course, use some judgment, but if you think you can swing the job *ask for all the job can stand.* A mouse may look at a king but a mouse never became one.
8. *Try to look prosperous.* This does not mean flashy clothes with pinched back waist and diagonal pockets. Immaculate linen, shined shoes and a visit to the barber are essential.
9. *Advertise yourself.* You may be a good salesman but you must have the opportunity to display your talents. Therefore, never miss an opportunity to widen your circle of acquaintances. If people say you are a self-advertiser, let them say so. It probably means you are getting results. Go to every gathering that is likely to bring you in contact with people of affairs. You cannot tell what one of them may be useful to you some day—and besides you will enjoy it. It is possible to be a "live wire" without being a "fresh guy."
10. *Be optimistic.* Even pessimists like optimists. You cannot feel angry when you turn up the corners of your mouth. Cheerfulness is as much a cause as an effect.

LETTERS FROM ALUMNI

Bridge Inspection

Things are very quiet just now in the offices of consulting bridge engineers. There are no large structures under construction in the country, few moderate sized ones, and poor prospects of any immediate improvement in the situation. The railroads seem to be following a definite waiting policy pending their return to private hands and the subsequent readjustments. They, along with municipalities and other public agencies, are seemingly paralyzed by the tremendous difference between pre-war and present estimates of the cost of construction. Private investors (or speculators) are willing to buy steel for apartment houses, loft buildings and moving picture theatres at four and five cents a pound,—but only because a large and quick return may be expected on the outlay. This is about the only activity in structural work in New York City at present, although many building projects are in the architects' and structural engineers' offices for study. Through the country at large the increase in the percentage of structural shop capacity contracted for from about 15 per cent last Spring to around 75 per cent this month is due mostly to the demands of the automobile manufacturers and allied interests. This prosperous industry is building new shops and new office and service buildings all over the country. Its confidence and enterprise is a boon to the bridge shops.

For the first time in many years Mr. Modjeski has now no engineer parties in the field on bridge construction. I was resident engineer myself on the last piece of work to be completed,—the remodeling of the Poughkeepsie bridge. This was carried on as a war-emergency measure during 1917–18 under priority orders. The new heavy Santa Fe type engines were allowed over the bridge in May of 1918 and the work fully completed in August of that year. (For two successive Junes I had the choicest of vantage points from which to have watched a Poughkeepsie regatta, but the river was empty). At the same time I was supervising the inspection of erection of the new bridge over the Ohio River at Louisville for the Pennsylvania Lines, necessitating frequent jumps between Pouphkeepsie and Louisville. This work had been started by another engineer, who had entered the service and placed his practice in our hands to carry on. And as the chief inspector at Pittsburgh and the New York manager of our inspection organization had also put on khaki and turned their jobs over to me, I was kept pretty well on the jump all year. The attempt to keep competent inspectors and field engineers on the erection jobs and in the rolling mills and bridge shops against the competition of enlistment and the Draft Law made the year 1918 a hectic one.

After the armistice, as our men came back from the Service we were fortunate to have enough inspection work under way to be able to take them back, although conditions are still sub-normal. The lock gates and bridges crossing the New Orleans Navigation Canal are being fabricated under our supervision at the present time.

For comfort for the conditions in the immediate future I rely on the belief that this country cannot stand still for long in its construction of great steel structures and that before long conditions will have stabilized sufficiently to allow some of the great projects that are contemplated to be started.

With best wishes for the continued success of the CORNELL CIVIL ENGINEER, I remain,

Very truly yours,
CLEMENT E. CHASE, '10.

Fabricators Doing Little Bridge Work

Practically all of the work which we are handling in our structural shop these days consists of structural steel for mill buildings. In fact, I think, this is the general experience among bridge companies at the present time.

As an instance I learned at a recent meeting of the Bridge Builders & Structural Society that only five per cent of the work contracted for in the month of September was bridge work, the balance was buildings. The Bridge Builders & Structural Society represent one-third of the fabricators of this country.

The class of work which most of the bridge companies are doing at present is of very little interest from an engineer's point of view. It seems to me that the engineering in our line is being taken over more and more by consulting engineers leaving simply the manufacturing end of it for the bridge companies.

Regretting that I am not in position to submit an article of interest, and thanking you for the invitation, I remain,

Yours truly,
A. B. LOOMIS, '94.

In the Sanitary Corps

Your letter of September 18 has just reached me (October 18) after a return from leave, immediately after which I was ordered to Camp Benning, Columbus, Idaho from Ellington Field, Texas, where I have been located for some months past.

My experience in the Sanitary Corps has been a varied one, and I am afraid has included many things which do not take a very high technical rank, but which nevertheless are essential to the sanitation of an army post.

I have been on duty since my entry into the service at four different posts, in various parts of the South, being assigned in each case for duty as Camp Sanitary Engineer. This work includes supervision of the water supply and sewerage systems, disposal of wastes, fly and mosquito control, drainage and sanitary police.

I regret that I have nothing for the CIVIL ENGINEER at this time except my very best wishes for its success.

ARTHUR W. HARRINGTON,
1st Lieut., Sanitary Corps.

From the Phillipines

Since my arrival in the Phillipines, I have been teaching in the University of the Phillipines. I am an instructor in math and descript. In the afternoon I work in the Bureau of Public Works as an assistant engineer in the Irrigation Division. I am at present working on a job that will cost the government $800,000.

There are many Cornellians here in the Bureau. The director is Mr. Paez (M.C.E. '13). Then there are Messrs. Davidson (C.E. '11), Quisumbing (C.E. '08), and Mapua (Arch.), and one or two others. I don't know.

VIDAL A. TAN, '18.

Car Float Transfer Bridges

Comparatively little bridge work is being undertaken at the present time, largely due to the unsettled financial conditions of the railroad companies and over the country generally, but this office is fortunately engaged in the design of some car float transfer bridge which are critically needed at one of the railroad terminals in New York Harbor.

J. B. FRENCH, '85.

The annual meeting of the Cornell Society of Civil Engineers was held at the Cornell Club, New York City, Tuesday, October 21, 1919. There was a short business meeting and the following officers were elected for the ensuing year:

Ernest A. Truran, '95, president; Charles S. Rindfoss, '06, first vice-president; Walter L. Conwell, '11, second vice-president; Fred T. Coffey, '14, recording secretary; Carroll R. Harding, '10, corresponding secretary and treasurer.

It was reported at the meeting that the membership has just passed the mark of 1,000 members.

After the business meeting Mr. Fred W. Scheidenhelm, '06, gave a very interesting account of his experiences as Water Supply Officer of the First Army on the Somme, St. Mihiel and Meuse-Argonne fronts.

Key to the 1923 Class Photograph

First Row (left to right)

1. Texidor, A.
2. MacDonald, J. J.
3. Poselsky, A.
4. Burmistroff, V. G.
5. Spurny, F. E.
6. Haskell, E. E.
7. Ziegler, H. A.
8. Dudley, H. T.
9. MacNicol, Geo. B.
10. Dowd, A. J.
11. Cook, F. F.
12. Warner, F. W., Jr.

Second Row

1. Ellis, E. K.
2. Crouch, A. W.
3. Berry, D. W.
4. Williams, F. B.
5. Post, L. R.
6. Corcoran, W. B.
7. Williams, O. P.
8. Allen, D. F.
9. Hamilton, R. B.
10. Levy, H. B.
11. Hoffman, K. W.
12. Reed, J. R.

Third Row

1. Franz, P. J.
2. Bosworth, H. P.
3. Taylor, A. V.
4. Sutherland, W. W.
5. Paris, E. L.
6. Ruttenberg, J.
7. Crofoot, D. W.
8. Boardman, A. C.
9. Oehrlein, G. J.
10. Freeman, M. O.
11. Rollo, W. R.
12. Kelly, C. E.
13. Suarez, D. F.

Fourth Row

1. Temple, R. H.
2. Schmidt, R. L.
3. Davis, L. M.
4. Fleming, J. J.
5. Brunie, H. C.
6. Tinio, M. Q.
7. Grogen, M. J.
8. Hourigan, M. W.
9. Osthoff, R. H. L.
10. Fang, I. P.
11. Perez-y-Diaz, S. V.
12. Dyett, E. G.

Fifth Row

1. Pagliaro, F. J.
2. Weisberg, N.
3. Stiner, C. E.
4. Rowe, R. G.
5. Heasley, S. M.
6. Telfer, T.
7. Colby, T. B.
8. Howard, J. E.
9. Scott, B. A.
10. Baxter, D. B.
11. Gonzalez, P. O.
12. James, W. O.
13. Wang, K. S.

Sixth Row

1. Keliher, J.
2. Wheeler, E. P.
3. Diehl, E. P.
4. Schlobohm, F. J.
5. Clark, J.
6. Mitchell, F. V. E.
7. Milmoe, J. D.
8. Kohm, R. A.
9. Mueller, M. A.
10. Metz, L. A.
11. Tyldesley, T. B.
12. Palmer, B. H.
13. Davy, A. L.

Seventh Row

1. Osborne, M. L.
2. Maucieri, M.
3. Perlman, S.
4. McConnell, D. W.
5. Lovan, C. F.
6. Allen, W. M.
7. Dallas, W. B.
8. Cortina, V. C.
9. Carter, C. D. W., Jr.
10. Schmauss, C. J.
11. Stumpf, R. T.
12. Peters, J. H.

THE CORNELL CIVIL ENGINEER

PUBLISHED MONTHLY DURING THE COLLEGE YEAR BY

The Association of Civil Engineers of Cornell University

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EDITORIALS

English for Engineers

It is an unquestionable fact that graduates of four-year technical courses are heavily handicapped when competing with other professional men in positions of other than a strictly technical nature. They are not so fitted by their college course to fill positions of executive and administrative responsibility as are their classmates who were graduates in Arts or Law and the cases where four-year technical graduates do attain positions of this sort are records of individual achievement against odds. Engineering graduates, and even engineering students, are very often brought to a realization of the value of a more liberal education than a four-year course in engineering affords. The engineering colleges at Cornell, and technical schools generally, are recognizing this need and meeting it in a degree by requiring such courses as public speaking and political science. Liberal courses, however, have to compete for a place on the schedule with new technical courses, devised in the effort to keep abreast of the changing demands of engineering practice, and the already crowded schedule admits of little expansion. It becomes, therefore, a question for serious consideration whether all engineering courses should not be of at least five, or possibly six, years' duration, when it is insisted by one of Professor Northup's authority that an English course should be required of *all* freshmen. Beside bringing out in a convincing manner the need for such a course, Professor Northup in his article, "Practical English for Technical Students," suggests an outline for a systematic course of reading in the English classics. The author is a graduate of Cornell of the class of 1893 and is now Professor of English in the College of Arts and Sciences. Many graduates of the College of Civil Engineering will find his article to express exactly their opinions on the value of an English course to an engineer, and to many the course of reading, the course of reading he outlines will commend itself.

Recent Advances in the Length of Bridge Spans

There is a tendency in engineering to view every departure from precedent only as an innovation without seeing in true perspective its significance as a step in a gradual but continuous development and progression.

In history to rightly interpret the meaning of a particular event we need to view it not as an isolated incident but in the light of a whole series of past events. So in engineering to rightly understand the significance of a deviation from the beaten path of engineering practice it is essential to have as a background a knowledge of past progress in the particular field.

Professor H. S. Jacoby in this issue summarizes the advances which have been made in recent years in the length of spans of different classes of bridges. This article should be of special interest to bridge engineers throughout the country both because it is comprehensive and because it is authoritative. Professor Jacoby is a graduate of Lehigh of the class of 1877, has been a member of the faculty of the College of Civil Engineering for thirty years, and is the author or co-author of a number of widely-used textbooks.

The Value of a Hydraulic Horsepower

In an article entitled, "Economical Size of Pipe for a Given Loss of Head," printed in THE CIVIL ENGINEER of April, 1919, Dr. E. W. RETTGER gave a solution for a problem in the economics of hydraulic design, deriving original formulæ for pipe diameters in a line so designed that for a given or assumed total loss of head due to friction in the pipe the annual cost of the pipe is a minimum. In this issue he shows that the formulæ therein derived are in agreement with a formula which he derives on the basis of Adams' Rule. Each of these formulæ contain a term which represents "the value of a hydraulic horsepower at the wheel." There seems to be no general agreement as to the exact significance of this term and for different interpretations different results are obtained. Professor Rettger, in his article, shows the application of the formulæ derived for several different interpretations of the value of a hydraulic horsepower at the wheel.

Selling Your Own Service

It cannot be doubted that many men owe their success in large measure to their ability to favorably impress other men, with whom they have business dealings. It is no less true that many men are seriously handicapped because of their inability to make a favorable impression, even though they are really of superior ability as professional men. Striking example of this are almost daily brought to our attention. History is full of them. Men whose education was terminated before they finished high school are now heads of great companies, bank presidents, and railroad officials. We are usually willing to explain their success by believing that these are men of especially strong personality and of exceptional natural ability. This is perhaps part of the explanation but it is also true, as Mr. C. S. Rindsfoos says in his article in this issue, that very few men realize the need of the ability to sell their own service. And by "selling their own service" the author does not mean simply finding a new position for he says that all of us are selling our service every day in the year. Mr. Rindsfoos is particularly qualified to write on this subject for in addition to being himself an employer of engineers he has for some time up to recently been Chairman of the Registration Bureau of the Cornell Society of Civil Engineers and in this capacity has been instrumental in aiding a large number of Cornell men to sell their own service.

Outlook

The outlook for The Civil Engineer was never brighter in the memory of the present college generation than it now is. Subscriptions promptly paid up and articles generously contributed have permitted the enlargement of the Civil Engineer for November and it is the hope of the board not only that succeeding issues may be as large but that a still further enlargement may be practicable. We have just as earnest a desire to improve the quality of the publication, and to make it the best of the Cornell college publications, and the best technical school periodical in the country. In no other way can Cornell be better advertised. To this end we ask for your constructive criticism. Let us have from you your suggestions for articles, and your ideas as to how the Civil Engineer can be improved.

COLLEGE NOTES

Football

The obstinate defense and savage attack of the Cornell eleven, coupled with the desperate unceasing battling of the whole team, held the powerful Dartmouth football machine from a clean cut victory and limited the heavy favorites to a nine point score in the battle at the Polo Grounds, October 25. A punt blocked by Youngstrom, the Hanoverian right guard, was responsible for Dartmouth's touchdown. Robertson, Dartmouth's left halfback, scored the other three points when he kicked a field goal on his eighth attempt. Dartmouth made ten first downs to Cornell's two but failed in all seven of their attempts at a forward pass while Cornell in the last few minutes of play completed two. Cornell three times held the Green for downs when within the shadow of her own goal posts.

On November 1, Lafayette's strong offensive brought defeat to Cornell, 21 to 2. In spite of the fact that Shiverick was the only regular in the Cornell backfield, a very considerable improvement in the Varsity offensive was noticeable. Shiverick played his usual brilliant game but this did not offset the smoothness with which the entire Lafayette backfield worked.

November 8, Carnegie Tech was defeated 20 to 0, all of the points being scored by Shiverick. The Carnegie attack and defense were by no means weak and the victory of the Varsity brightened Cornell's prospects for the Penn State game.

The aerial attack of the smoothly working Penn State machine sent Cornell down to defeat, 20 to 0, on November 15. The Varsity, however, played better football than in any previous game of the season. First downs for the Varsity were more frequent than before, and succcessful forward passes netted long gains and once placed them within striking distance of the Penn State line. The Varsity again demonstrated that it makes the strongest defenses when standing on its own goal line. Twice Penn State lost the ball on downs within the five yard line. On their last score Penn State's backs were three times held one foot from the goal line. On the fourth down Robb circled left end for a touchdown.

In the time honored Thanksgiving Day classic Pennsylvania won a clean-cut victory by the score of 24–0. She was held scoreless until nearly the end of the first half. Twice the Cornell line held four downs within the one-yard line. For three downs Penn had been held with practically no gain on the twelve-yard line. On the fourth down a forward pass over the Cornell goal line was completed. The half ended with the score at 7–0. In the second half Penn's aerial work and penalties imposed on the Cornell team paved the way for two more touchdowns and a field goal added three more points to Penn's total. The Penn game concluded a season of five defeats and three victories. Cornell has been defeated by teams which are rated among the best eastern teams of the season: Colgate, Dartmouth, Lafayette, Penn State, and Penn. The varsity has fought to the final whistle as valiantly in defeat as in victory. Undergraduate and alumni support has been of the sort which brings encouragement to a team. Knowledge of the facts and that a wealth of material will be eligible for football next Fall do not permit Cornell's 1920 prospects be overshadowed by the defeats of this season.

The Varsity Cross Country

At the Syracuse Invitation Meet on October 25th, the Varsity was at a distinct disadvantage due to the fact that Wenz was unable to run in the meet and Dickinson being taken with a cramp shortly after the race began, was forced to withdraw. In spite of those handicaps the team took fourth place in a field of ten teams. On Saturday, November 1, Harvard was defeated at Cambridge by the score of 18 to 37, Varsity runners taking first, second, fourth, fifth and sixth places. On the following Saturday they won even more decisively from Carnegie Tech. seven men placing before a Carnegie man crossed the line.

In the intercollegiates held November 22 at VanCortlandt Park, New York, Cornell took third place. Syracuse was first and Princeton second. McDermott of Cornell was the fourth man to finish.

Cornell Needs New Buildings

The need for new buildings at Cornell is brought out in a section of the latest report of the President. He mentions specifically:

A new central heating plant, which will cost about $500,000.

A fire-proof addition to the Library building, already overcrowded which would cost from $250,000 to $500,000 according to its size.

A fire-proof addition to the building occupied by the College of Law for housing the valuable law library, which would cost not less than $100,000.

A mechanical laboratory and a hydraulic laboratory for the College of Engineering, each of which would cost about $300,000.

Several residential halls for students, costing, according to size, from $150,000 to $300,000.

A central dining hall for young men in the residential halls, costing about $500,000.

A building as a social center for the University, costing about $500,000.

A new gymnasium costing about $500,000.

A new gymnasium and playground north of Fall Creek Gorge, for women, costing not less than $250,000.

An administration building for the University costing between $250,000 and $300,000.

"There is a great need," President Schurman reports, "of a fund to be used for the beautifying of the Campus, gorges, ornamental grounds and for the repair and reconstruction of roads and paths. An immediate outlay for these purposes of $150,000 to $200,000 would provide much needed practical improvements and effect an aesthetic transformation."

Basketball

There are about 80 men working out for the basketball team this year and although only two men, Captain J. Molinet, '21, and I. Sidman, '20, from last year's team are eligible, the prospects for a good team are bright. H. B. Ortner, '19, captain of the '16–'17 and '18–'19 teams is coaching the team this year and has made no cut in the squad as yet. Practice is being held nightly and Ortner is planning to give every man a thorough tryout before selecting the team. A hard schedule includes fourteen home games and seven games on foreign courts. The schedule follows:

Dec. 10	Hobart at Ithaca.
Dec. 13	Colgate at Ithaca.
Dec. 16	Niagara at Ithaca.

Dec.	19	Princeton at Ithaca.
Jan.	7	Bucknell at Ithaca.
Jan.	13	Union at Ithaca.
Jan.	16	Yale at New Haven.
Jan.	17	Dartmouth at Hanover.
Jan.	21	Dartmouth at Ithaca.
Jan.	23	Buffalo at Buffalo.
Jan.	24	Rochester at Rochester.
Jan.	29	Clarkson at Ithaca.
Feb.	14	Yale at Ithaca.
Feb.	18	West Virginia at Ithaca.
Feb.	21	Penn at Philadelphia.
Feb.	24	Rochester at Ithaca.
Feb.	27	Princeton at Princeton.
Feb.	28	Columbia at New York.
Mar.	2	St. Lawrence at Ithaca.
Mar.	5	Penn at Ithaca.
Mar.	9	Columbia at Ithaca.

The Endowment Fund Campaign

The international drive to raise an endowment fund of $10,000,000 for Cornell has been successfully launched and is being pushed not only in the United States but in every foreign country where there are 25 Cornell alumni as well. The income of the first $5,000,000 is to be used exclusively for increasing the salaries of the instructors and professors. The necessity of this increase is evident. In the words of President Schurman: "The teacher must be paid, if not in proportion to the value of the high service he performs for society, at least on a basis of the compensation received by men of equal intelligence, education, and energy, in other professions." The additional $5,000,000 will be used to meet the need for increased equipment, enlarged buildings, and improved grounds.

Among the prominent alumni enlisted in the campaign are Prince Victor N. Narayan, '08, of the State of Cooch Behar, India, godson of Queen Victoria; Mario Garcia Menocal, '88, President of Cuba; and Alfred Sze, '01, Chinese Ambassador to Great Britain.

Cornell's technical and scientific schools are one of the factors contributing to the large registration of foreign students it has had since its founding. It is to increase the technical as well as the other department facilities that Cornell is seeking $10,000,000 of her alumni and the general public.

Artillery Horses

The Field Artillery Branch of the R. O. T. C. will be a center of activity this year, especially Department "B" known as the Drivers' Section. The last part of October 88 horses arrived in Ithaca for the instruction work in artillery. These horses, every one black, were with the First Division in France and are splendid animals. The cadets in Department "B" are having instruction in the care and management of the horses varied by an occasional dash out into the surrounding country, in the various formations of cavalry drill. A test of their ability as horsemen is to be given for members of the artillery branch and if they pass this test satisfactorily they will be granted the privilege of taking a mount out at any time they desire. Other students in the university can receive instruction on week-day mornings in equitation. This affords lovers of this form of exercise an opportunity to ride and any others who desire to learn a chance to do so if they have vacant hours mornings.

Fraternity House Robberies

A series of robberies which for several weeks baffled the local police was brought to an end on the night of November 5, when two boys aged 15 and 19 and a girl, aged 14, were arrested by the Ithaca authorities.

On the night of October 12 the Delta Upsilon house was looted of all the watches, fountain pens and money to be found on the second floor. Ten days later the same house was again looted. October 29 the Delta Chi house was visited and pocket books containing over one hundred dollars were taken. November 2 the Kappa Psi house was entered, Several nights later Alexander's pressing shop was robbed of over twenty suits belonging to students.

When the trio was questioned by the police the ring leader of the gang confessed to the fraternity house robberies but disclaimed any knowledge of the robbery of the cleaning house establishment. The juvenile criminals had eluded the police of Ithaca, New York City, Buffalo, Elmira and several other central New York cities for over three weeks. During the course of their travels the children stole and lost nine Ford cars in various cities. In Elmira alone they stole five machines.

Cross Country Club Plans

The Cross Country Club has renewed its activities and arranged for several runs during the latter part of November and the first part of December.

On November 15 were held the third freshmen cross country cup run, a novice run open to sophomores, juniors, and seniors who have not represented the Varsity this year, and a blind handicap run open to Varsity men. Three prizes were given in both the novice and the blind handicap run.

On November 22 was held the annual intercollege run. It was won by M. E., with Agriculture second. C.E. finished fifth. The Cross Country Club awarded the four "C's" to the first man, Brown, of Agriculture, to finish and medals to each of the first seven men.

The first underclass cross country run will take place on December 6. The first seven men across the line will be awarded their numerals.

Freshman Football

The freshman football team this year seems to contain considerable good material for next year's Varsity. Carey, captain of the team, who plays at quarter, Mason, fullback, Munns at end, and Schiebler at left half have shown up especially well. On October 14 the Ithaca High School was defeated 35 to 14 and the Buffalo Technical High School met defeat on October 18th, 13 to 7. On October 25, Wyoming Seminary won from the freshmen 12 to 0 on good forward passing. Though heavier, the visitors made but one first down by rushing on the freshmen. The first year men defeated the second Varsity after the Varsity-Lafayette game on November 1st, 7 to 6. Although the Cornell freshman team carried the play into the Yale territory for almost the entire game, the New Haven first year men broke away on two occasions winning the game on November 8 by a score of 10 to 0. The Penn State freshmen were defeated November 15 before the Penn State-Varsity game, 19 to 14. Forward passes figured largely in the victory and the punting and passing of Carey were features.

The freshman team lost on November 22 to the Penn freshman team by a 7–2 score. In this game Cary of the Cornell team created quite a sensation by his punting, his punts averaging more than 45 yards.

Soccer

That Cornell is again hitting its pre-war stride is further evidenced by the resumption of soccer. The squad numbers 25 men, several of whom have had experience on the 1916 or 1917 teams, and is being coached by J. I. Campbell of Rochester. Captain Emil Hassan, '20, center-half, Florsheim, '20, right and Welles, '18, outside right are veterans of former varsity teams.

The first game of the season on November 1, with Yale was our victory by a score of 5–0. On November 8, the game with Harvard resulted in a 2–2 tie, one of the varsity men accidentally kicking the ball over our goal, thus scoring a point for Harvard.

On November 22 Princeton won a 2–1 victory in an extra period. The Haverford game November 27, resulted in a tie. In the last game of the season, November 29, Cornell was defeated by Pennsylvania by a score of 2–0.

Lacrosse

Lacrosse is to be revived at Cornell after a lapse of three years. Among those who are going out for the team are: J. C. Baldwin, '18, who played on the championship team of 1916, A. M. Volkhardt, '19, W. B. Cunneen, '19, and J. Brady, '19, all of whom were on the 1917 team which never got into action, all the games having been cancelled because of the war. The team will make both a southern and an eastern trip. On the southern trip, among others, they will play the Navy, Maryland Agricultural College, and Johns Hopkins. They also hope to get games with Lehigh, Hobart, Yale, Stevens, and Harvard. The outlook is very bright and a successful season is expected.

University Concerts

The Department of Music has announced its pre-festival concerts for the seventeenth season. The following program has been arranged for the concerts: Frieda Hempel, for seven consecutive seasons leading soprano of the Metropolitan Opera Company, November 13; Fritz Kreisler, December 10; Detroit Symphony Orchestra, Ossip Gabrilowitsch, conductor, January 10; Philadelphia Orchestra, Leopold Stokowski conductor, March 17.

Bailey Hall was thronged with an audience of more than two thousand people at the opening concert of the pre-festival series, given by Frieda Hempel. Not a seat in the orchestra or balcony was left unoccupied, and chairs were put upon the stage in an effort to accommodate all who wished to attend. The selections which Miss Hempel gave were received with very genuine enthusiasm. She was assisted by Mr. Bos, who accompanied her on the piano, and by Mr. Rodeman, flutist.

New Dean of the Medical College

The University Trustees have elected Dr. W. L. Niles '02, of the Department of Medicine, Dean of the Cornell University Medical College to fill the vacancy left by the death of Dr. William M. Polk.

Dr. Niles entered Cornell in 1896 and received the degree of M.D. in 1902. He sang in the Cornell Glee Club for three years and was a member of Sphinx Head and the Savage Club. After serving for two years as an interne at the Bellevue Hospital, Dr. Niles, in 1904, began the practice of medicine in New York City, and in the same year was appointed instructor in medicine in the Medical College. Dr. Niles has been Acting Dean during the past year.

Plans for the Musical Clubs

Plans have been completed for the annual Christmas trip of the Musical Clubs. This will be the first trip that the Clubs have made since the winter of 1916–17. The net proceeds of the trip will be devoted entirely to the Endowment Fund.

The holiday trip which 60 of the members will make includes the following cities: Buffalo, Statler Hotel Auditorium, December 26; Akron, Ohio, Akron Army Auditorium, December 27; Cleveland, Statler Hotel Auditorium, December 28; St. Louis, The Odeon, December 30; Chicago, Orchestral Hall, December 31; Cincinnati, Emery Auditorium of the Ohio Mechanics Institute, January 1; Pittsburgh, Carnegie Music Hall, January 2; New York, Waldorf-Astoria Ballroom, January 3.

Football Coaches

Due to the decision of Doctor A. L. Sharpe to return to Yale as Director of Athletics, Cornell was confronted with the problem of selecting a new football coach, "Speedy" Rush, formerly of Princeton, was finally selected as head coach and he has associated with him Ray Van Ornam, '08, as coach of ends and "Gib" Cool '16, as coach of the line. J. J. Munns '14, captain of the 1913 team, a member of the varsity for three years, and a team-mate of "Gib" Cool, and C. H. Shuler '15, brother of J. D. Shuler, present varsity fullback, were back to assist in coaching the team for the Dartmouth game. "Chuck" Barrett '16, and "Dutch" Hoffman '16, of the championship 1915 team came to Ithaca to help point the men for the Penn State game.

Fraternities Pledge 460 Men

The year 1919–20 has been a banner year for the fraternities on the hill. Organized into the Inter-Fraternity Association they have just successfully completed an organized rushing season with few violations (and these only minor ones) of the Inter-Fraternity rushing rules. Four hundred and sixty men were pledged, the majority of these, as usual, being freshmen, although the other classes were liberally represented. This is a record number.

The Short Course Begins The winter course of three months at the State Agriculture College of Cornell began November 5 with a registration of 330. This is the largest registration since that in 1913–14 when the registration was 555. The number of women registered in the course is not yet known but it is known that there are more women registered in general agriculture, floriculture, animal and poultry husbandry than in the home economics courses.

The registration in the winter course will probably never again equal the former high figures, according to authorities at the college, because the agricultural schools of the State are furnishing instruction similar to that which is given here in this course.

Reopening of the Dutch Kitchen The management of the Ithaca Hotel has won much favor by re-opening the "Dutch" Kitchen which has been closed since Ithaca went dry in October, 1918. The opening of the Kitchen is primarily to provide a meeting place for upperclassmen in the University when downtown. Publications from all prominent colleges will be on file and at the disposal of the students. On days of out of town games reports on the progress of the Cornell teams will be announced. Efforts will be made to give the "Dutch" its former popularity. Soft drinks and light lunches will be served. The Red and Green rooms will be reserved as of old for private dinners and parties.

The University Band The University Band this year is the largest in the history of the organization. New instruments have been sent to Cornell by the Government and 50 men made the trip to the Cornell-Penn Thanksgiving-Day game in Philadelphia. To raise money toward the expenses of the trip four dances were held in the Old Armory by the Band. A collection was taken at the Penn State game and several hunderd dollars were realized by a campaign on the Hill with an individual tax of 25 cents. This was used to send the football scrubs as well as the band to Penn.

Wrestling Wrestling prospects are very uncertain this year. Coach O'Connell has 120 men working out but there is a scarcity of experienced material in the heavier classes. C. E. Ackerly, '20, winner of the 115 pound intercollegiate championship is captain of the team. E. E. Conroy, '20, winner of the 135 pound title at the intercollegiates last year is also eligible. Dual meets at Ithaca with Penn, Columbia and Princeton and meets with Penn State, Lehigh and the Navy away from home have been arranged beside the Intercollegiates which will be held in New York. It is planned to hold a Novice Meet before the Christmas vacation and the University Championship Meet soon after vacation.

Interscholastic Race

The first interscholastic cross country run that has been held under the direction of the Athletic Association since 1917, took place November 15. The high schools represented were: Buffalo, Hutchinson, Lafayette, Ithaca, Schenectady, Erasmus Hall, Bethlehem Prep. and Elmira Free Academy. The team honors were taken by Buffalo High School with a low score of 39 points. Hutchinson High School was second with 49, Lafayette third with 57, Ithaca fourth with 85, and Schenectady fifth with 125. The other three entries did not have five men and therefore did not have any team scores.

Farmers' Week

The interest and attendance at a recent conference of farm bureau agents justify the expectation that the annual Farmers' Week to be held February 9 to 13 inclusive will greatly surpass any previous week. The keynote of the week will be marketing and rural economies, not only as they affect the farmer, but as they affect the householder. It is intended to publish and distribute to all prospective visitors well in advance of the conference a complete program so that those who are not able to spend the entire week here will be able to make a better choice of days on which to attend.

Crew

Nearly 300 oarsmen reported for fall crew practice and during the excellent October weather Mr. Courtney had between 75 and 100 candidates on the inlet every afternoon. A large number of the veterans from last year's boats have returned, and the members of the freshman crew that defeated the Princeton yearlings last Spring Day, are working hard for a place on this year's Varsity combination.

Tau Beta Pi Elections

At the recent elections of Tau Beta Pi, ten men were elected to membership in the Society. Four of these were from the College of Civil Engineering, five from Sibley, and one from Chemistry. The C. E. men honored were: J. H. Christian, C. J. Hasbrouck, A. E. Hunkin, and H. H. Linnell.

Elected University Trustee

The Trustees have elected I. A. Place, '81, of New York City, a member of the board, to fill the vacancy caused by the death of Andrew Carnegie. Mr. Place is vice-president of the New York Central Railroad Company, in charge of law, land, tax, and claim departments. He was one of the alumni trustees of the University from 1910 until last June, when he declined to be a candidate for re-election by the alumni. He helped to organize the Cornellian Council in 1908 and was its first president, holding that office until 1915.

Senior Honorary Societies

The following undergraduates in the College of Civil Engineering are members of the Senior honorary societies: Quill and Dagger: L. G. Clay, M. W. Herriman, H. I. Hettinger, A. E. Hunkin, D. G. Nethercot, J. E. Smith; Sphinx Head: T. C. McDermott, J. P. Mac Bean, D. A. Ruhl.

C. E. Association

Members of the Association of Civil Engineers were addressed on October 15 by Dean E. E. Haskell, '79, and by Colonel H. R. Lordly, '93. Dean Haskell spoke on the question of establishing the honor system in the College as it was before the war. The speech by Colonel Lordly was in praise of the CORNELL CIVIL ENGINEER, and touched on the value of this publication as an advertisement for the College both in America and abroad. The Association elected the following officers:

H. J. Benisch, '20, president; R. B. Bowles, '20, vice-president; R. S. Shempf, '20, secretary; B. J. Harrison, '20, treasurer; A. V. D. Wallace, jr., '20, athletic director; Asst. Prof. L. C. Urquhart, '09, faculty adviser.

Freshman Cross Country

While the Varsity was winning the cross country run against Harvard at Cambridge on November 1, the freshman squad was scoring a victory over the Hobart Varsity at Geneva. The final score was 25 to 31, Cornell first year men finishing in first, third, fourth, eighth, ninth and tenth places.

On November 22 the freshmen cross country team brought glory to Cornell by winning the freshman cross country championship at Van Cortlandt Park in New York. They won from Yale, Columbia and Penn teams, five of the first ten men wearing the Red and White.

ALUMNI NOTES

'88. Orville Bensen, who was lately discharged as a Major of Engineers, is now connected with the American Bridge Co., at Pequannock, N. J.

'95. William M. Torrance, is Vice-President and Chief Engineer of the Carson Construction Co., of Savannah, Ga.

'95. John Weatherson has just recently returned from France and is now a Physician with office at 30 N. Michigan Bldg., Chicago. He is residing at 5758 Grand Bldg., Chicago, Ill.

'05. William B. Freeman is now Manager of the Lock Joint Pipe Co. of Denver, Colorado. His residence is 1256 Lafayette St., Denver.

'07. Chester G. Wigley has severed his connection with the Wallace & Tiernan Co., and is now with Clyde Potts, '01, at 30 Church Street, New York.

'08. Elliot Vandevanter is Superintendent of Construction with the Whiting-Turner Construction Co. of 403 Stewart Bldg., Baltimore, Md. His home address is Linthicum Heights, Annarundel Co., Md.

'08. H. K. Wilson is Assistant Engineer with B. H. Davis, Consulting Engineer, at 17 Battery Place, New York City.

'10. Behrman I. Ellis is a Major with the U. S. A. Engineers. His home address is 1121 E. Baltimore St., Baltimore, Md.

'10. Thos. S. Hauck is Assistant Engineer for the Interborough Rapid Transit Co. He gives his temporary residence as Apartment 67, 603 W. 140th St., N. Y. C., and his permanent address as 2225 Eutaw Pl., Baltimore, Md.

'10. H. H. Jones is Secretary and Treasurer of the Lapan Logging Co., Jackson Bay. His address is Jackson Bay, British Columbia.

'10. G. V. Steele is Assistant Engineer for the Corrugated Bar Co., 17 Battery Pl., N. Y. C. His home address is 245 State St., Flushing, N. Y.

'11. Clarence R. Bliss returned from overseas on August 30, 1919, and is now at his home, 89 Chestnut St., North Adams, Mass.

'11. James R. Webb is with the Turner Construction Co., at 244 Northern Ave., New York City His home address is 75 Northern Ave., New York City.

'12. Matt M. Bird has given us his address as Knoxville, Tenn., in care of the State Highway Commission.

'12. W. F. Flynn has changed his address from 1940 Biltmore St., Washington, D. C., to 1534 E. Capitol St., Washington, D. C.

'12. Harry H. Frank is Engineer for Hunting-Daves Co., Century Bldg., Pittsburgh, Pa. He is living at 753 Melton St., Pittsburgh, Pa.

'12. George C. Sloane is a structural engineer with the DuPont de Nemours and Co. His home address is 1733 T St., N. W., Washington, D. C.

'12. William A. White can be reached at the following address: 1600 Eutaw Place, Baltimore, Maryland.

'13. H. A. R. Austin announces his marriage to Miss B. M. Hancock of Riverside, Cal. He is Assistant Engineer in the Division of Hydrography and is located at 14 Capitol Building, Honolulu, T. H.

'13. Harold I. Confield is Assistant Construction Engineer with Charles H. Tenney & Co., Boston, Mass. His home address is 183 Harvard Ave., Allston P. O. Station, Boston, Mass.

'13. Wallace D. Du Pre is Manager of the Ford Agency at Spartanburg, S. C. His residence is at 233 N. Church St.

'13. Roger W. Parkhurst, Adjutant of the 7th U. S. Engineers is now at Camp Gordon, Ga. His home address is 611 West 136th St., New York City.

'13. R. W. Parkhurst writes us that C. S. Hunt, A. L. Stevenson, (C.E., '13), and E. S. Healy, (C.E., '12), are all with the Electric Bond & Share Co., of New York City.

'13. Theodore L. Welles, Jr., is Engineer for the Crowill & Little Construction Co., 1951 East 57th St., Cleveland, Ohio.

'13. Russell D. Welsh is a draftsman for the West Penn Power Co., at 221 Benedum-Trees Bldg., Pittsburgh, Pa. He lives at 428 Stratton Lane, Pittsburgh, Pa.

'14. Neil McMath is residing at 215 Iroquois Ave., Detroit, Mich.

'14. Thomas T. Newbold is Field Engineer for Irwin & Leighton, Naval Dirigible Hangar, Lakehurst, N. J. His home address is 202 Macon St., Brooklyn, N. Y.

'14. Herbert B. Pope is Assistant Superntendent with the Turner Construction Co., of New York City, and is now located at Houston, Texas, in Room 422 of the Mason Building. His home address is 209 Washington Ave., Haddonfield, N. J.

'14. Harold B. Wright is an Engineer for the New York State Highway Department, and resides at 5 Jewett Place, Utica, N. Y.

'15. Lieut. G. F. Healey has entered the Bureau of Public Roads, Washington, D. C.

'15. J. R. Grime is in charge of construction work for the Du Pont Company, at the Arlington Works. His home address is Arlington, N. J.

'15. Seth G. Hess is located with the U. S. Shipping Board as Senior Engineer at 140 N. Broad St., Philadelphia, Pa. He gives his temporary address as 4620 Cedar Ave., Philadelphia, Pa.

'15. N. S. Perkins is with Perkins & Kuzmier, Engineers and Contractors, 116 Nassau St., New York City. His home address is 110 South 10th Ave., Mt. Vernon, N. Y.

'15. Charles F. Radford is County Highway Engineer, Menomnie County, Michigan. His home address is at Hermansville, Mich.

'15. Alan F. Williams is in the Engineering Department of the A. T. and S. F. Railroad Co. He can be reached thru the following address: P. O. 125, Williams, Ariz.

'16. Fred C. Brandes gives his mailing address as 1022 Newton St., N. E. Washington, D. C. His home is at White Plains, N. Y.

'16. Gerald E. Brower has returned from overseas and is at Kelly Field, San Antonio, Texas. He is a Captain attached to the Air Service and received the Aerial Observer's, and R. M. A. (pilot) ratings while overseas.

'16. H. A. Foster is Structural Designer for J. P. Robinson & Co., of 148 Duane St., N. Y. C. His home address is 205 Garfield Place, South Orange, N. J.

'16. Chas. P. Frost is Field Engineer for the Carson Construction Co., of Savannah, Ga. At present he is located at Gordon, Ga. His home address is 253 Church St., Poughkeepsie, N. Y.

'16. H. S. Lee is English Secretary to Chief Engineer, Tientsin Pukow Railway, Tientsin, China. His home address is Yu Yao, China.

'16. Herman C. Loeffler is a student in the City Manager course given at the Bureau of Municipal Research, 261 Broadway, New York City. His home address is 21 McKinley Ave., Glendale, L. I., N. Y.

'16. F. B. Mullen is in the contracting business. He lives at 448 Hillside Ave., Jamaica, N. Y.

'16. Jack T. Nash who was overseas as 2d Lieutenant in the 524th Engineers has resumed his connection with the Henry Exall Elrod Co., as Chief Office Engineer at Dallas, Texas.

'16. A. F. Perry is in the Engineering Department of the Texas Co., and can be addressed at Port Arthur, Texas.

'16. Leslie E. Pierce, 2d Lieutenant, U. S. A., is in charge of S. and A. Branch of Airplane Dept., Eng. Div., of Air Service, McCook Field, Dayton, Ohio. Home address: 129 Grove St., Stanford, Conn.

'16. Otto C. Vieweg can be reached at 161 DeWitt Ave., Elmira, N. Y.

'17. Walter V. Benson is at Cornell University, teaching Mechanics in Sibley College.

'17. John H. Courtney who is with the Bethlehem Shipbuilding Corp., is situated at the Harlan Plant. His home address is 1411 West St., Wilmington, Del.

'17. W. R. Dillard is Designer and Estimator for the Converse Bridge and Steel Co., Chattanooga, Tenn. His residence is at Washington, Ga.

'17. J. Fruchtbaum advises us that E. B. Holdredge, '10, and D. H. Judson, '07, are with him in the office of the Truscon Steel Co., of Syracuse, N. Y.

'17. C. D. Livant is with the Bethlehem Construction Co. His home address is 913 Grant Ave., Bethlehem, Pa.

'17. Robert G. Mead is salesman for the Graphoscope-Development Co., of New York City. His residence is at 23 So. Highland Ave., of the same city.

'17. Harold G. Miller's address is changed from 220 Roseville Ave., Newark, N. J., to 1352 Perkiomen Ave., Reading, Pa.

'18. G. H. S. McNair has accepted a position with the contracting firm of Spencer, White & Prentis, Inc. The firm's New York office is at 47 West 42d Street.

'18. Nicholas J. Walbran of Oriskany, N. Y., returned from France and was discharged a 2d Lieutenant of Engineers on Sept. 10, 1919.

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The Class of 1920

THE CORNELL CIVIL ENGINEER

and

Transactions of the Association of Civil Engineers
of Cornell University

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Vol. 28 DECEMBER, 1919 No. 3

ENGINEERING WORK IN BASE SECTION No. 1, A. E. F.

Col. Wm. G. Atwood, '92

Largely as a result of the recommendations of Marshal Joffre soon after the United States entered the war, it was decided to organize nine regiments of Engineers for railroad service. At this time the compulsory service law was not in force, and, therefore, these regiments were organized as volunteer units under the Reserve Law passed the previous year. All of them except the 7th Reserve Engineers were commanded by regular officers of the Corps of Engineers. After the passage of the National Army Law the designation of these regiments was changed from the 1st, 2d, etc., U. S. Reserve Engineers to the 11th, 12th, etc., Engineers (Railway).

Organization. The 7th Reserve Engineers, later the 17th Engineers (Railway), was organized in Atlanta by Colonel John Stephen Sewell, a graduate of the Unites States Military Academy, with 16 years service in the Corps of Engineers, but who had been a successful business man and contractor for the preceding ten years. This combination of civilian and military experience was most fortunate for the regiment. It would be very fortunate for the country as a whole if its army officers could receive, in addition to the requisite military training, a considerable amount of business training.

Owing to the fact that these were the first regiments organized in the United States for overseas service, there were a great many very able men available as officers. The officers were selected by Col. Sewall, in consultation with Mr. Samuel Felton, the Railroad Advisor to the Chief of Engineers. As soon as the more experienced officers reported, they were assigned the selection of the enlisted personnel. Lists were prepared showing the number of men of each trade and occupation which it was thought would be needed for a well-balanced organization of 1,000 men, this being the authorized strength of an Engineer regiment at that time. These classifications were adhered to as closely as possible in selecting from the large number of applicants, and the railroad service record of each applicant for enlistment was carefully scrutinized, which resulted in an unusually efficient organization.

The enlisted personnel was classified as follows:

Actually from railroad service	840
Auto and truck drivers and mechanics	33
Clerks, railroad and others	161
Miscellaneous	93

The railroad men classified as follows:

Construction and maintenance	679
Operating department	104
Mechanical department	157

Many of the men had had experience in several departments, and were classified according to the Department in which their most recent or considerable experience had been obtained, but it was generally insisted, in enlisting operating men, that they should also have had construction and maintenance experience. For instance, locomotive enginemen must have operated steam shovels and cranes, and many of the conductors had been bridge or track foremen, etc.

There were the following Cornell men in the regiment:

W. G. Atwood, C.E. '92, Major, promoted to Colonel; C. W. Fitch, C.E. '10, Private, promoted to Lt. Col.; F. E. Lawrence, C.E. '06, 1st Lt., promoted to Major; R. M. DeGarmo, C.E. '09, 1st Lt., promoted to Major; E. H. Taliaferro, C.E. '10, Captain, promoted to Major R. L. James, C.E. '12, 2d Lt., promoted to Captain; J. A. Dickinson, C.E. '10, 1st Lt., promoted to Captain; H. G. Halleck, M.E. '04, 1st Lieut., promoted to Captain, Tank Corps; A. S. Hart. C.E. '14, Private, promoted to 1st Lt.; W. R. Dillard, C.E., '16, Pvt., promoted to 1st Lt.; R. W. White, M.E. '08, 1st Lt., transferred to Tank Corps; P. H. Wood, Undergraduate, Private, promoted to Sgt.

In your present freshman class there is Master Engineer M. J. Grogan, who was recommended for a commission but never received it.

Equipment. The military equipment furnished was very unsatisfactory. Krag rifles, blanket rolls and haversacks from the Spanish American War, and canteens from the Civil War were mixed with modern mess kits and a few other more recent items. No colors were furnished, and our National Colors did not reach us until the middle of 1918, while the Regimental Colors were never furnished and were made in France.

A Board of Officers appointed by the Regimental Commander made up a list of tools and construction equipment which it was thought would be needed, but our superiors disapproved the requisitions on the ground that we would never need this amount of equipment. Such small supplies of tools as were purchased for us were not in our hands until three months after we landed in France, and for that length of time we had to work with what we could buy, borrow or steal—principally the latter. That our lists were not unreasonable was shown by the fact that at the time of the Armistice we not only had all the tools we asked for originally, but several times that number.

On November 11th, 1918, at the time of the Armistice, we were operating approximately the following heavy equipment: 5 steam shovels, 5 track pile drivers, 10 locomotive cranes, 4 floating pile drivers with derrick barges and tenders, the barges being built by us and the machinery furnished from the United States, 1 suction dredge, about 10 locomotives, 100 each of dump cars and ballast cars, a large number of concrete mixers, and a very large miscellaneous assortment of small tools. We also had about 400 motor vehicles of various kinds, approximately 350 of them being trucks of a capacity between two and five tons, together with a considerable number of road rollers. As this equipment commenced to accumulate, the necessity for a repair shop was quickly seen. Most of our requisitions for shop tools were disapproved, but, due to the highly developed sense of acquisition of the regiment at the closing of construction, our machine- and blacksmith shop had about 20 blacksmith fires, and employed about 150 machinists. We also had four saw and planing mills, largely occupied in resawing lumber to the proper sizes and making doors, windows, and other mill work, as well as framing building timber.

Overseas Trip. We never received any official orders to leave Atlanta, but the Southern Railway told us that they had instructions to move us to Hoboken for embarkation; so we left. Some months after our arrival in France the officers tried to collect certain traveling expenses authorized by Army regulations and were told that the Quartermaster Corps had no record of any orders for us to go to France, consequently, we could not be there, and, therefore, the expenses were not payable. The Quartermaster Corps was finally persuaded that we were in France and paid the claims.

Our convoy assembled at Halifax, where we joined three others of our Railroad Regiments, together with some British troops. We had a quiet voyage across the Atlantic, and landed at Liverpool, moving out out of there on the same day to a camp formerly used by the Canadians, in the Aldershot area. We received a very warm welcome in passing through the English cities, and I think none of us will forget how we were cheered up by the band of the Royal Engineers that met us on our arrival at midnight in the midst of a cold and blinding rainstorm.

Two days later the four Engineer regiments were ordered to parade in London, where we were reviewed by King George. We were the first foreign armed troops in England since the landing of William of Orange, and we received a very warm welcome. The English papers commented very pleasantly on the appearance of our troops, although the average period of training—which was unknown to the papers—had been about three weeks. An article entitled "Solemn Looking Blokes" in an American magazine commented particularly on the solemnity of the men and the lack of attention which they paid to the crowds. This was not due, as the article assumed, to a feeling of the solemnity of the occasion nearly as much as it was to the fact that the men were so untrained and had been so forcibly cautioned for the preceding two days as to the necessity of marching at strict attention and paying no heed to anything but keeping step, that they couldn't help looking solemn. The following night we sailed from Southampton to LeHavre on a cattle boat that was decidedly crowded. Every one slept wherever he could, one of the officers the next morning remarking that he slept exceedingly well except at such times as someone stepped in his face. From Havre we were transported by rail to St. Nazaire, where it was our fate to remain.

We noticed quite a change in the method of handling troops as we approached the theatre of war. We left Atlanta with one train for our motor and other equipment and three trains for the Regiment; in crossing England we had a baggage train and two trains of coaches, but in France our trucks and baggage moved by ordinary freight and the entire regiment in one train.

Organization in France. The transportation and supply services of the American Army were organized in what was known then as the Line of Communications, later as the Services of Supply, or the S. O. S. The territory under this jurisdiction extended from the ports to the rear of the active army and was divided into sections for convenience of administration. We read in American papers of a double track railroad built from the Coast to the front, and I have several times been asked if I built it. I wish to say that there was no such railroad. St. Nazaire was made the Headquarters of Base Section No. 1, and Colonel Sewall, our Regimental Commander, was made Section Engineer, in charge of all construction in the Section, and on his promotion I succeeded him.

St. Nazaire was a small and very dirty seaport, with about 35,000 population before the war. It is a comparatively modern town, although Caesar was camped near its site at one time, and there are still standing some Druid remains, which are probably 1400 years old.

Base Section No. 1 covered an area about the size of Massachusetts. It extended from LaRochelle to Brest and the Channel ports of Cherbourg and St. Malo, and contained all or a part of the former provinces of Brittany, Vendee, Touraine and Normandy. The main line of the Paris-Orleans Railway, which was destined to become one of the main lines of communication of the A. E. F., terminated at St. Nazaire. This is a good, double track railroad, following the Loire River to Tours, and, consequently, has low grades. There are a number of connecting lines from Brest, LaRochelle, Bordeaux, and other points both from the north and the south

The two principal ports of the Loire are St. Nazaire, at the mouth of the river, and Nantes, a city of 200,000 population, 40 miles upstream. The wharves at Nantes are in the open river, principally constructed on concrete piles, some with wood and some with reinforced concrete docks. The draft of ships is limited to about 21 feet by a reef which crosses the river abour 10 miles above St. Nazaire.

The wharves of St. Nazaire are in two connected tidal basins with a permissible draft over the mitre sills of the locks of about 28 feet, and berthing space for about 20 ships. The extreme range of tide at this point is about 19 feet.

The older of the two basins at St. Nazaire was built between 1845 and 1850. The track facilities were very poor, being of the Continental type, in which all switching is done over turntables by hand. It was a strange sight for us to see cars being moved long distances by German prisoners, and, occasionally, by horses. This, of course, made the operations very slow and required a large force of men in proportion to the amount of work done. There were a few good stone warehouses, but many of them were frame and in poor condition.

It was manifest that if American equipment were to be used, the existing method of switching was impossible and that even if it were not, much man power would be saved and the freight movement greatly expedited if a locomotive switching system were to be installed. Plans for making the necessary changes were developed and presented to the French. They were greatly horrified to see that we proposed, in one or two instances, to put tracks through perfectly good stone buildings, but finally consented when we agreed to restore the buildings after the war. After the French saw the new tracks in operation, the Mayor of St. Naziare said that the improvement was so manifest that we would not be required to restore the buildings belonging to the city. This track work was started, but progress was very much hampered by lack of tools—not only track tools but tools of all kinds. Work had to be done so far as possible without interruption to the heavy and rapidly increasing traffic. The reconstruction project involved the building of 2¼ acres of warehouses, principally of concrete blocks, laying 8½ miles of track, the installation of 64 switches, 11 crossing frogs, and the placing of 14,400 sq. yds. of Belgian block and concrete pavement.

The freight handling equipment in the port was of many kinds and ages, and much of it was not particularly efficient. It, nevertheless, was better than found in most American ports. There were two large cranes, one of 150 and the other of 180 tons ultimate capacity, which were very useful when we began to receive locomotives on their own wheels and the 90-ton 14 inch guns. Incidentally, it might be mentioned that a part of the time three big cranes were operated by women, and in the shops the traveling cranes were almost all operated by women. I have seen a woman pick up and set down an 80-ton locomotive, take her hand off the controller and pick up her embroidery.

At Nantes the berths assigned for the use of the A. E. F. were somewhat better equipped than those of St. Nazaire, but on one wharf trackwork of a similar nature to that at St. Naziare was required. In this case it involved the partial reconstruction of the reinforced concrete deck of the wharf, as well as 6 miles of track, 43 switches and three acres of warehouses.

The work above-mentioned was merely increasing the capacity of the existing facilities, but the possible expansion had a limit, and it was soon seen that this limit would be reached long before the total capacity was sufficient to handle the expected freight tonnage, and that an entirely new port was necessary. It had been decided by the General Staff that 45 days supply for the A. E. F. should at all times be in stock at the base ports and that approximately 40 per cent. of this should be at the Loire ports. This necessitated a great increase in storage capacity.

Some time before the war the French had prepared plans for a new port about 10 miles below Nantes, and this project had been tentatively adopted by our own Headquarters. The location, however, was above the reef in the Loire, so that the draft was limited, and we, therefore, sought for a better location. This was found at Montoir, about four miles from St. Nazaire. On September 30, 1917, tentative plans were submitted and recommendations made that the greater part of the development in the Loire should be made at Montoir. These plans were approved in principle sometime in 1918 after about 30 miles of track in the proposed yard had been already laid.

A large number of soundings and borings in the bed of the river had to be taken and some test piles driven. We had no equipment for this purpose and the French had very little. The only tugs not in mine sweeping or similar service were not of much value, and the sounding barge that we finally obtained had to be moved by hand much of the time. A French pile driver is a peculiar and inefficient machine, according to our ideas. The pile does not set back in the leads but is in front of them and the steam hammer simply rests on the pile; that is, it does when the pile does not fly out from under it. Instead of the valve in the hammer being thrown up mechanically, as in American hammers, this is done by hand. A French driver will drive about one-tenth to one-eighth as many piles per day as a good American driver. The lack of efficiency of this machine explains the horror and surprise of the French at our audacity in proposing to build a new wharf which would require 9,000 or 10,000 piles.

The final plan of the yard called for an out-bound and an in-bound system, with the engine house and engine tracks, repair tracks, storage yards and warehouses between the two systems. Freight from both the old harbor and the new wharf concentrated at the west end or throat of the outbound receiving yard. From the receiving yard it passed over the hump into the departure or storage classification yards. The inbound system was practically the same. Each of the six yards was designed with 20 body tracks, varying from 1500 to 2800 feet in length in the clear.

The location for the yard was so flat that it did not drain, there being no point in the entire area over one-half meter above the lowest. For peacetime construction this condition would have required large expenditure and much time for drainage, but in wartime we wore hip boots and did not drain it. When the first track was laid in December, 1917, the whole area was covered with not less than three inches of water. Fortunately, there were very few houses on the track, and we were able to so locate the yard that only one house was interferred with. This one was in the middle of the engine yard and could not be avoided. Under French law it is impossible to requisition an *occupied* house, and for various reasons it was impossible for us to buy this one. Tracks were laid up to it on each side and, in fact, one of them ended on the doorstep. Then, one day when the inhabitants were all away a terrible accident happened. Two cars got away on adjoining tracks and went clear through the house. After that the house was not occupied and could be condemned.

There was insufficient labor and material available to permit any appreciable progress until May, 1918, and from that time on the supply of material, tools and labor, all of which continually increased, determined the speed of construction.

Work was begun on the wharf for general cargo in June, 1918, with a track pile driver, no other machines being available. There were many delays due to the lack of material, tools and labor, the especial shortage being bitts for the air motors for boring. Some thoughtful person in the United States had carefully selected air compressors and motors and sent them over together, but had totally neglected sending any bitts with them. Practically the entire double track 3,000-foot approach was driven with track drivers before we were able to get the machinery for the floating drivers. We finally received everything but anchors, but, as a scow driver is not of much use in a 2-knot current without anchors, we continued to keep our track drivers going until anchors could be found.

The ammunition wharf at the east end of the main yard could not be commenced on account of the shoratge of timber until just a short time before the Armistice, and, therefore, only a small amount of work was done on it.

Of the warehouses in the storage yard, 68 were 50 ft. by 400 ft., four were 240 feet by 500 feet, with bolted steel frames covered with corrugated iron, and the remainder were wooden frames 50 feet by 500 feet with corrugated iron roofs and sides. The small steel buildings were supposed to be of identical construction, but each fabricating shop took the liberty of making minor changes, and we often wished we had the inspectors where we could punch them instead of the badly fitting gusset plates. It was also very cheering to find, a ship's manifest that read—as we sometimes did—"1,200 bundles building steel; some of this was dropped overboard, but we don't know which pieces." The large buildings were a model of design for construction under these conditions, as almost all the parts were interchangeable.

The lumber for the frame buildings came very largely from Scandanavia, and much of it had to be re-sawed. A re-saw mill with a daily capacity of 60,000 feet, together with portable gasoline saw sets, framed practically all the timber. At the time of the Armistice the building gangs, of about 300 men each, were divided into four sections—foundation, framing, erection and corrugated iron. Two of these gangs were erecting the buildings at the rate of three a day, and in one case the entire frame for a building was set up ready for the iron in one hour and forty-five minutes. The men employed on this class of work, as well as on the wharf, were very largely German prisoners. As there was insufficient lumber for flooring in a job of this magnitude it was necessary to fill each building to a height which would make the contents safe from over-flow. Two steam shovels were employed in a rock cut within a mile of the yard, another shovel, and for a time two, were working at LaBaule, 12 miles away, in the sand dunes, and a suction dredge was pumping sand out of the river, which was handled by locomotive cranes onto cars. From these three sources the fill in the buildings and the ballast for the tracks was obtained.

When work was stopped on November 11th, out of approximately 300 miles of track in the main and adjoining yards, about 170 miles were completed, and out of approximately 100 acres of warehouses 79 acres were under roof. The water system, shops and other accessories for a plant of this kind were in about the same state of completion as the main yard.

The general cargo wharf had a face 2,000 feet long, and the approach was 3,000 feet long, the whole structure containing about 9,000 piles, of which 2,400 were in the approach. When work was stopped the approach was completed and the piling was driven for about 1,500 feet of the main dock.

A yard was constructed at LaRochelle for car erection which was an example of the difficulties encountered in the early construction work. This yard contained only about 18 miles of track, but the ground was rough and there were no American tools available. The grading involved about 15,000 yards of light cut and fill and it was done with French hand tools, some wheelbarrow hauls being over 500 feet. It would have been a very simple piece of work if there had been a small steam shovel, scrapers or any other equipment available, but it finally was completed by main strength, using about every method of moving dirt that should not have been used for rapid or economical work.

Two other small yards were constructed; one at Nantes for storage and classification, and one at Saumur, 125 miles from St. Nazaire, for a Division terminal, including a connection between the main line and the branch from LaRochelle.

The St. Luce yard at Nantes involved 280,000 cu. yds. of embankment, most of which had to be borrowed. This had to be obtained from the river by the use of a type of plant peculiar to Europe. The sand was excavated from the bed of the river and loaded into barges by ladder dredges. The barges were towed to a suction dredge and pumped out into hoppers on shore, from which meter gauge dump cars were loaded. This does not seem an efficient method to us, but it worked. There was also some light cut and fill, which was done with an elevating grader and dump wagons. This was a new system in France and it created a great deal of interest among the French Engineers. This yard contained slightly under 20 miles of track and about eight acres of warehouses and barracks, of which two-thirds was completed on November 11th.

The Saumur yard was small, only 12 miles of track, with a small engine house and shop, but it involved a pile trestle 2,500 feet long crossing over the P-O main line and connecting the LaRochelle branch with the new yard and the main line. Pile driving was done with a track driver, but, owing to the non-arrival of piling, most of which came from the Vosges Mountains, the driver was only able to work a few days a week.

Camps. The list of camp work was long and would have seemed important had it not been overshadowed by the port and water supply work. Some of them, such as the Tractor Artillery School at Angers and the Field Artillery School at Saumur, made use in part of existing French plants, while others were entirely new construction.

There were two artillery training camps, one at Coetquidan and the other at Meucon, with ranges, aviation and balloon camps. Each of these camps had a floor area of barracks and other buildings of about 60 acres. The gun positions on the range were so arranged that a full brigade of 75's and 155's could fire at once.

An aerial gunnery, machine gun and ordnance school at St. Jean des Monts required 11 acres of barracks and hangars, and the grading of a flying field. In this part of France fences are built of dirt, and, as the fields are small, the grading of the field involved the leveling of about 12 miles of these fences. The soil was sand, and it was necessary to do a large amount of rolling and to stimulate the growth of sand grass to form a turf so that the planes would not turn over when landing.

In the vicinity of St. Nazaire and Montoir camp space was required for about 150,000 men. In some of the more permanent camps the ordinary system of Company messes was abandoned and consolidated mess halls were built, which turned out to be extremely efficient. In the stevedore camp, which held 8,000 men, four mess halls 100 feet by 160 feet were constructed, and as troops began to move toward home the embarkation camps were similarly equipped. It was found to be possible with this arrangement, to feed 7,500 men an hour from each kitchen.

In all the camps the men were much more crowded in barracks than in the United States. We placed 96 men in a building 6 meters by 30 meters by the use of 4-man double deck bunks. There were no bad results from lack of air space, as was shown by the fact that there was no epidemic of "flu" as there was in the United States. possibly because most of the buildings admitted plenty of air through cracks in the walls.

Hospitals. There were seven Base Hospitals in Base Section No. 1, ranging in authorized capacity from 1,000 beds at Quiberon to 24,000 beds at Savenay. Six of the hospitals had a total of about 15,000 beds, and five of them were in large cities and furnished no unusual construction problems.

Savenay Hospital was located just outside of the small town of that name and was originally intended for a 1000-bed hospital. At the time its construction was ordered, in September, 1917, we could get almost no lumber, but we could get brick, so the construction was of a permanent nature. Later, we learned from the French to use brick and concrete blocks in a very economical manner. Posts and roof trusses for a building were set up as though it were to be a frame building, but instead of using siding a 4 inch wall of brick or blocks was built between the posts. This made a much better building than if it were all frame, and, with the prevailing prices of material, it was cheaper. It also offered the advantage of enabling us to use European labor for laying brick, which could not be used for anything else. An American bricklayer does not do a good job on this kind of a wall, but an European mason, using a drier mortar, does very well. The authorized size of the hospital was increased progressively until it reached 20,000 active and 4,000 convalescent beds, of which 17,000 were in use at the close of construction.

The hospital was on a hill overlooking the Loire, in a very desirable location except for the difficulty of getting railroad service and water. It was necessary to build a track from the main line 2½ miles in length on a 2½ per cent grade. After reaching the hospital grounds spurs were built so that the entire 600 acres which were to have been occupied were within easy reach of track facilities.

The area of the buildings actually in use at the close of construction was 26.9 acres, with about 6 miles of railroad track, 5.1 miles of sewers and 5.8 miles of water main 4 inches and over in size.

In addition to the base hospitals each of the large camps and schools had camp hospitals with a capacity of from 100 to 500 beds.

Water Supply and Sanitation. Each of the large camps required very considerable sanitary installations, but for the sake of brevity, only a few of them will be mentioned.

The Coetquidan artillery camp was an enlargement of a small French camp of instruction and already had a sewage disposal plant on a system somewhat similar to the Imhoff. We increased the capacity of the disposal plant and extended the sewer system. There were 5.5 miles of new sewer laid of all sizes up to 24 inches.

The conditions covering water supply were peculiar. The camp and range were on a low hill of a material known locally as granulite. It was a rotten, pervious granulite, which had been eroded so that at the foot of the hill one came in contact with a mica schist which was impervious. The water stored in the granulite was practically the only possible source of supply, and therefore it was necessary to tap this supply in a number of places. Sone of these sources furnished a quality of water which permitted treatment by chlorination and filtration, while others did not. On this account a dual water system, one potable and one non-potable, which is unusual in the United States, was installed.

The system at Coetquidan consisted of five separate pumping stations, with 14.1 miles of pipe up to 10 inches in size, necessary filter plants and two concrete tanks holding 250,000 gallons.

The camp near Meucon was located in the same geological formation but was an entirely new camp. Six and seven-tenths miles of sewers from 4 inches to 20 inches were laid. The potable water system had about seven miles of main and about six miles of distribution pipe, and the non-potable system about five miles, or altogether about 18 miles of water pipe. One of the sources of supply for potable water was a very large spring, near which was a Chapel dedicated to "Our Lady of the Fountain," and said to have once been a Druid shrine. There was a granite structure about 10 feet high over the spring on which one could still see remains of old carvings and which was said to antedate the Christianization of this part of France.

The Savenay Hospital being located in the country, required entirely new sanitary works. The sewage disposal plant was of the Imhoff type and had to be redesigned several times on account of the increase in the size of the hospital. There were about five miles of sewers up to 24 inches. On account of the isolated location of the hospital practically all of this was cement pipe manufactured on the ground.

The water system was originally designed for a 5,000-bed hospital, with the A. E. F. allowance at that time of 25 gallons per day per patient, but after its construction was commenced the plans had to be revised to care for the increase in the size of the hospital.

The original plans contemplated the construction of an arched concrete dam 45 feet high, containing about 6,000 cu. yds. of concrete, with a rapid sand filter just below it, a pumping station to work against a head of 280 feet, a reinforced concrete water tower with a capacity of 80,000 gallons in the center of the hospital grounds, together with the necessary distribution system. When the plans for the dam were presented to the French Engineers they refused to approve them because of the fact that they were not acquainted with this type of construction and insisted that the section should be a gravity section. This lack of approval did not worry us particularly, and about the time the dam was completed and had 8 or 10 feet of water behind it the plans were approved, with the hope expressed that we would never find it necessary to completely fill the reservoir. From information acquired later we believe that this is the only arched dam in Europe.

When the last 10,000-bed extension was ordered it was necessary to enlarge the filter capacity and look for a further water supply. This was found in an adjoining valley which was crossed by a highway on a high embankment. It was decided to use this embankment as a dam and to install a pumping plant to raise the water over the divide so that it would flow into the other reservoir and thereby avoid the necessity of constructing another filter plant. The slope of the embankment was flattened with carefully puddled material and a reinforced concrete blanket constructed over the entire slope. This expedient was entirely successful, and the two reservoirs impounded about 260,000,000 gallons. The concrete standpipe at the hospital had been located higher than any of the buildings then contemplated, but the later expansions necessitated going on higher ground with the new units, so that a 50,000-gallon standard railway water tank on a high frame was erected as a supplementary reservoir. There was a short time before this additional service was installed, when water was very scarce at the hospital units on top of the hill. I recently met a Medical officer who was stationed at one of these units for a few weeks just at this time, and he could not say enough bad things about the Savenay water supply. His ignorance of conditions and the fact that the difficulty was soon corrected are an example of the many unjustified kicks made about so many of the operations of the A. E. F.

The sewerage systems for the camps in the vicinity of St. Nazaire included two Imhoff tanks and 23.6 miles of pipe up to 30-inch, a large part of this pipe being also made at Savenay. One great difficulty we had at St. Nazaire was in establishing the sewer grades for the reason that the rock was only about 2 feet under the surface and on account of the time involved in excavating it, it was necessary to get the sewer excavations just as shallow as possible.

The existing water supply for St. Nazaire was totally inadequate for the developments planned for the city, and one of the first studies taken up had to do with its increase.

The city supply was obtained from two series of small reservoirs with a total drainage area of only about four square miles. The filter plant, of the slow sand type, had a capacity of 750,000 gallons per day, and it was estimated that 3,000,000 gallons would be needed. Again the French protested at the size of our figures and urged us instead of increasing the water supply to this extent to reduce the consumption.

We could only reply that while the consumption of a man could be restricted, a large part of the water supply was for the use of locomotives and the locomotive erection shop, and that one could not reason with an American locomotive.

The first work started was the construction of the so-called Bois Jolland dam for impounding 550,000,000 gallons of water. This was to be an earth dam containing 35,000 yards. When construction was started there were no tools available except French picks and shovels and a few wheelbarrows, and some of the dirt was carried from the borrow-pit to the dam in *boxes* and tamped in place by hand. We had a sergeant in charge of the dam who became very much disgusted on account of the fluctuation in the force and the construction methods which had to be followed. He remarked one day in his Irish dialect that the dam would never be finished, and if it was finished it would never have any water in it, and if it had any water in it, it would get out. The dam was finished, but, as was the case with all the other reservoirs constructed, there was no time for stripping. When I saw this place last July the roofs of several houses were just above the water level.

As the plans for the port development grew the water requirements, of course, grew with them. We finally built several reservoirs at distances of from 10 to 25 miles from St. Nazaire. One of these was an earth dam impounding 200,000,000 gallons. There were two masonry dams between 500 and 600 years old that were repaired and put in service, and an expedient somewhat similar to that of the second dam at Savenay was adopted at another place. The up-stream face of a railroad embankment near the town of Pontchateau was puddled and a crib dam built under a 50-foot arch. This dam also held about 300.000.000 gallons. The various reservoirs had a total drainage area of about 90 square miles.

The water was conducted from these reservoirs in open channels to the pumping station which had a capacity of 7,200,000 gallons per day and lifted the water into the Bois Jolland reservoir, from which it flowed by gravity to the filters. During the winter there was sufficient run-off from the watershed above Pontchateau so that the upper reservoirs filled and sufficient surplus reached the pumps to fill the Bois Jolland reservoir in addition to supplying current needs, so that in the spring of 1919 there were about 1,250,000,000 gallons in storage in all the reservoirs.

This water supply system was one of the most difficult problems we had to solve, as we were barely able with our construction to keep ahead of the consumption requirements. At the time the pumps were started on the Pontchateau water there were only two days supply of water left in the city reservoirs.

The final success of this plan was very largely due to the ability and ingenuity of Major John B. Hawley, who, with a part of his battalion of the 503d Engineers, had reported to the Commanding Officer of the 17th Engineers for duty in December, 1917. Under the direction of Major Hawley, Capt. T. L. Fountain, C.E. '05, had charge of sewer work.

Roads. The highway work in the Base Section was of two classes—maintenance of existing main highways and the construction of new roads, gun parks, etc.,i n the camp and hospital grounds.

The French roads are famous for their good quality but they were mainly water bound macadam and went to pieces very rapidly under the heavy truck traffic to which they were subjected. Most of them were not constructed to carry the wheel loads that were put on them. One case that gave us a considerable amount of trouble was in the roads used by the tractor artillery school at Angers, where 18-ton tractors were used for pulling 8-inch Howitzers, these guns having a 12-ton axle load.

As much stone as was possible was purchased commercially, but we also operated six quarries which produced during their period of operation a total of 45,000 yards of rock. The work in this department was probably as difficult as that in any on account of the absolute lack of equipment. The quarry outfits were made up largely of junk picked up all over France, repaired and rebuilt in our own shops. The supply of motor trucks and rollers was never sufficient. As a result, the roads were in much worse condition at the time of the armistice than they were in 1917, and after the armistice practically the entire construction force in the Base Section was concentrated on road reconstruction.

Material. Construction material of all kinds was very hard to obtain and it was frequently necessary to use some article that seemed totally unfitted for its purpose because the proper article was not obtainable

A few miles of track material were obtained from the French, but aside from this, all rail, switches and fastenings were shipped from the United States, and, as we were working at a base port, we generally had these articles in sufficient quantity. At times ships would come in with a considerable amount of track material in the bottom of the hold and take it back as ballast. There was a story of one ship that had condensed milk, hay and 80-lb. rail in her hold. When she reached France it was a sort of hay porridge, with the rail stirring it, and, so far as I heard during the active period this particular cargo was never fully unloaded. It, of course, generally happened that when a ship carried back some specific articles as ballast these were the things most needed.

A large quantity of ties, bridge timber and piles were cut by the American Forestry troops in French forests all over France. In some cases this involved quite difficult work in delivery. Most of the long piles came from the Vosges and had their initial movement over narrow gauge roads with high curvature. This was a difficult matter with 100-ft. piles. The Forestry Department's products were supplemented by large quantities of ties shipped from Portugal and by some heavy timber and piles from the United States. The Portugese ties were largely half-round pole ties which gave a poor rail bearing, but they were much better than no ties at all. Advantage was taken of a number of new ships built on the Pacific Coast which were loaded with flour at ports near their point of construction, and on which deck-loads of piles or timber were afterwards placed. These were always good fir piles, but one shipment of yellow pine piling was received at Bordeaux which was anything but good to begin with, and some intelligent stevedore in the United States, finding it difficult to stow long piling, had cut off 20 feet. It should be said to his credit, however, that he sent the short pieces.

A large part of the building lumber used in Base Section No. 1 came from Scandanavia, but until the submarine campaign had been beaten we had very little lumber, and the buildings had to be constructed without it. Brick was generally obtainable, and in the latter part of the war the Corps of Engineers operated several French and English concrete mills. Before that time we, in our ignorance of French market conditions, used some very poor cement. There is no standard for Portland cement as there is in this country, and almost anything is called Portland.

Water pipe of the sizes needed was very hard to get, and we frequently had to double or triple the pipe lines in order to get the required capacity. In the case of six miles of 24-inch pipe for the St. Nazaire water works, we were fortunate enough to find a small quantity at one of the French foundries and to get them to cast the balance needed. The supply for Montoir yard and camp required the laying of temporary lines to serve until the new filter plant could be completed. Enough wrought iron pipe was available for one 4-inch and one 6-inch line about two miles long, but this did not give enough capacity. To overcome this difficulty we installed motor-driven centrifugal pumps at the center of both lines as boosters, and this scheme was quite successful.

The supply of material was so uncertain, and it was so difficult to secure items which should be used for any given work that the substitutions which had to be made offered the greatest opportunity for resourcefulness and ingenuity

Labor. In the early days of construction in 1917 most of the labor was furnished by the regiment itself, although at times considerable help was obtained from combat troops disembarked at St. Naziare and detailed for construction work during their stay in the rest camp, "rest camp" being merely a name. One of the negroes belonging to a combat regiment was heard one day to address some newly arrived troops marching into camp somewhat as follows: "Have a good time with dem guns, boys, because day lets yo' keep 'em a couple of days and then gives yo' a pick." It can be readily understood that we were not the most popular organization in France with newly arrived troops. This method of supplying labor was extremely unsatisfactory from a construction standpoint. The force changed from day to day, and the number of men available for the next day's work was generally not known until 3:00 o'clock on the preceding afternoon. This made necessary very quick work in making up the labor schedules for the next day. Later in the year, service battalions began to arrive, and, as they were officered by Engineers, they were of a good deal more value than the combat troops. Too much credit cannot be given the enlisted men of the Engineer organizations for the way in which they threw themselves into the work. Our trainmen, for instance, worked 12 hours per day five days in the week and 24 hours on the sixth day in order to enable them to get the seventh day off. Of course, it was beyond human possibility to keep this up for any length of time, but a number of the men did do it until they were thoroughly broken down and had to be sent home.

Attempts were made to employ as much civilian labor as could be secured, but man power was very short in France and the only laborers available were those unfit for military service. This, of course, meant that they were not physically fitted for hard labor. We did, however, secure a great deal of assistance from them as bricklayers, machinists and some similar skilled trades. A Labor Bureau was organized as an adjunct to the General Purchasing Board, and after this we began to receive labor of all kinds. In Base Section No. 1 we had Spaniards, Portugese, Chinese, Kabyles from the Sudan, and some others, and in some of the other sections there were in addition to these classifications a large number of Italians. After it was found that certain classes of the Italian troops could not be relied upon for combat service they were used as labor and replaced as fighting troops by the other Allies.

This mixture of labor, which had to be housed and treated in different ways, introduced a number of complications, especially on account of the difference in their rations. For instance, the Chinese were furnished with a large rice ration and not much meat, and the Kabyles being Mahommedans, had to be furnished special food. These different nationalities varied to some extent as to efficiency, but it was our experience that the relative efficiency of the interpreters quite largely determined the efficiency of the men. We had in the 17th a number of former foremen who spoke several languages, and, of course, the men working under them were generally quite efficient. Some of the enlisted men showed quite a little ability in acquiring languages. I heard one of our sergeants one day giving orders to the Kabyles which they seemed to understand. I asked him where he learned the language and he said he just picked it up—that he never had any trouble picking up any of the lingoes except Japanese, which it took him a month or two to learn.

Early in 1918 the negro service battalions began to arrive, and, as the regiment was largely made up of Southerners, we were able to make excellent use of them. The Southern negro laborer was the best workman that we had, particularly those organizations officered by Southern white men, although there appeared to be objections on this side to doing the obviously proper thing, and in some cases we had to arrange for the relief of the officers from the North who did not understand negroes, and replace them with Southerners. The negroes were of very much greater value to the A. E. F. in the labor organizations than they were as combat troops.

Late in the summer of 1918 we had a number of combat organizations assigned, owing to the great shortage of any other kind of labor, and these units were of varying value, and all of them, of course, thoroughly disgusted with their assignment. It was a very difficult thing in our own regiment, as well as other organizations, to keep the men interested in their work and get them to work efficiently when they all wanted to be at the Front.

When the construction work was stopped at the time of the armistice we had in the Base Section, reporting to the Section Engineer, slightly over 33,000 troops, civilians and German prisoners, there being about 8,000 of the later.

The construction work of the A. E. F. had to be carried on with a constant and severe shortage of labor, material and tools. The success which was attained was largely due to the loyalty of the Engineers to the job and their hard work, as well as to the fact that many of them had the ability to make use not only of their own former experience but of that of others as well, in working out the knotty problems which came up from day to day. Both the French and British Engineers aided us greatly by their advice and by giving us the benefit of their experience acquired during three hard years of war. Another thing which you should always bear in mind is that even if the other man's ways are not your own ways, generally his experience can teach you something if you will learn, and it is your duty to yourself and your client to learn whatever and whenever you can.

The Engineering profession does not offer large financial returns, but it does offer an unequalled opportunity for service, and the idea of the necessity for service is a thing which received great stimulus from the war. Many of our labor and industrial troubles are readily curable if those interested and their advisers can develop a less selfish attitude and have more desire to serve others. The educated engineer belongs to a profession which offers great opportunities along these lines, and the future of this country, and, therefore, by virtue of the power and standing of the United States, the future of the world lies largely in the hands of the engineer, and all engineers, especially those who are just entering the profession, should fit themselves to exercise this power with not only justice but intelligence. Lack of judgment and ability is oftentimes as disastrous as unfairness and injustice. Engineering training, with the addition of that culture which is the inspiration of all leaders of men, should prevent failure from any of these causes.

THE COURSE IN CIVIL ENGINEERING AT CORNELL UNIVERSITY

Ira W. McConnell, '97

Engineering education has been for some years past under study by the profession as to its effectiveness for the purposes for which it is intended. It has been attacked from almost every angle and almost every type of remedy has been suggested. Without inquiring as to the effectiveness of engineering education as contrasted with legal education, medical education or business education it is very clear that those who use the services of engineers are setting up certain requirements which the profession cannot afford to ignore.

Some years ago this movement crystalized into a joint effort on the part of the National Engineering Societies, the Society for the Promotion of Engineering Education and the Carnegie Foundation to formulate this problem and to give more definite direction to the study of beneficial remedies. This effort has resulted in the production of several partial reports, the one by Prof. Charles R. Mann, appearing as Bulletin No. 11 of the Carnegie Foundation, being a concise statement of present conditions, a discussion of the problems and the suggestion of certain solutions for the difficulties. The Mann report is a highly valuable contribution to the general subject and its information, discussions and conclusions should be thoughfully considered by every one who undertakes to discuss the subject of Engineering Education.

In the early months of his study for this report Prof. Mann sent out questionnaires intended to elicit from engineers their views as to the qualities which a competent engineer should possess. As a sort of composite average of those questionnaires the proposition has been set up that the successful engineer must have the following qualities rated in relative value in the order named:

Character, resourcefulness, judgment, efficiency, understanding of men, knowledge of technique.

It is a strange thing that the leaders of engineering thought along educational lines should so confuse the issue. The first five qualities named or any two of them will be a practical guarantee of some success in any calling to the young man who has the good fortune to possess them. But an engineer without knowledge of technique is like hot water without the tea which gives to it a distinctive flavor. How can a man with all those qualities be an engineer without knowledge of technique? And significantly enough —knowledge of technique is the particular quality which can be taught at technical schools, and *is* taught there regardless of the degree of possession of the others.

To my mind the foundations of character are laid in the very early years of life, long before the college has any chance to exercise any sway. Orderly personal habits, self restraint, obedience, persistence, respect for authority, thoughtfulness for the welfare of others, and many other of the fundamental qualities which go to make up character are partly inborn, but mostly taught at the mother's knee. The mothers and fathers of this world must continue as heretofore to lay the solid foundations of characters. We who build upon that foundation may well be concerned that we do not erect thereon a flimsy, lop-sided structure thinly veneered and filled with gaudy decorations and inflammables, but our real and lasting influence upon the heart of man will be mainly—if at all, through our example—whether as teachers or as practitioners—as men who persevere in diligence and in honorable conduct. So, I take it, our concern today is with the technical education of engineers and particularly that of civil engineers.

The standard four year course in Civil Engineering at Cornell consists now and always has consisted, so far as I can ascertain, of about 140 hours of credits. The foundation or core consisted 25 years ago of Mathematics, Physics, Chemistry, Descriptive Geometry, Mechanics Hydraulics, Surveying and Drawing. The course as laid down in the announcement for 1918–19 is made up as follows:

Foundation 42 per cent.	Hours	Total	Acc. Total
Mathematics	10	—	—
Physics	10	—	—
Chemistry	6	—	—
Descriptive Geometry	4		
Mecanics	10		
Hydraulics	3		
Surveying (including summer survey)	14		
Drawing	6	63	63
Scientific and Cultural, 12 per cent.			
Introductory Lectures	1		
Practical Geology	6		
Political Economy	4		
Public Speaking	3		
Specifications and Contracts	2	16	79
General Engineering Information, 17 per cent.			
Laboratory (Chem. & Phys. Lab. not included)	7		
Materials of Construction	3		

Enginering Construction	3		
Engineering Design	3		
Heat Engines and Auxiliaries	3		
Electrical Engineering	4	23	102
Applied Civil Engineering, 29 per cent.			
Railroads	5		
Bridges	7		
Concrete	3		
Water Supply	3		
Municipal Sanitation	3		
Elective	18	39	141
Military Drill	12	12	153
Subtract			
Military Drill	12		
Summer Survey	5	17	136

That is, the 136 hours here shown may be said to be the subjects represented by the four years of nine months each making up the essentials of the course.

The nomenclature of the classification into which the subjects have been divided is mine. It is, of course, subject to change in detail due to minor differences of opinion. Military Drill and Summer Survey are not included in the percentage conmputations because they represent—if nothing more—aids to health and cannot be regarded, in my view, as any tax upon the student's energies but rather an aid thereto.

Now this course of study shows very plainly the result of two influences; namely, the influence of the old faculty headed by Prof. Fuertes, and the influence of the later day efforts at revision.

The older influence is shown in the general outline of the course. The sekelton is the same; most of the muscles are the same; the pains, penalties and rewards for acquiring this course must be much the same as those of 25 years ago.

The influence of the later Faculty is apparant, however, upon closer inspection. The course in English in the Arts College is no longer required. Our old and beloved friends Least Squares and Geodesy have been absent from the required work for years and the sad part of that loss is that those who never take these subjects can have no adequate conception of what they miss. Astronomy is no longer required and I am told that the work in Railroads, Framed Structures, Hydraulics, sanitary subjects and laboratory work have undergone significant modifications, not visible from catalogue inspection. The courses in Public Speaking, Heat Engines, Electrical Engineering, Water Supply and some new electives are the significant additions. I am advised also that systematic *and* constructive criticism of written work for the purpose of bringing out defects in English is carried on.

Now the question is—What can be done to improve the course? The members of the Faculty have, in my opinion, worked consistently and with a large measure of success in the delineation of a course for civil engineers which has a sound foundation and which gives the student as much opportunity as the time at his disposal will permit to gain a knowledge of the general subject of civil engineering. The course as laid out does not cater to men who expect to specialize in some of the branches of civil engineering except as the 18 hours of elective work may permit such specialization, but it does give every student who follows it a fairly comprehensive view of the whole field as followed by civil engineers. It supplies a lack in the course of 25 years ago which I have keenly felt in my own practice, of the fundamentals of Heat Engines and Electrical Engineering. It would be strengthened, in my judgment, for the average practitioner by the addition of the fundamentals of machine design and of shop practice and production methods.

It is pertinent to the discussion here that we realize the impossibility of adding much to our four year curriculum unless we provide more time or drop some of the work which has heretofore been regarded as valuable for the student to acquire at college. It is very doubtful if any material number of hours can be made available by the elimination from the course of subjects now required for they all represent something of value. By a somewhat fundamental change in viewpoint, which will be indicated later, some gains may be possible, but that change in viewpoint involves such a material shortening of the course on the one hand as to lead to completion in three years; or to such a lengthening of the course on the other hand as will require five or six or more years to complete it.

The technical schools of today face a somewhat different problem from that which they faced 25 years ago. Most of the members of the classes prior to 1900—perhaps later—were from the country or from country towns. A great many of them had already gained some experience at self-support. Nearly all of them knew what work meant. They could handle horses, tools, to some degree men. They had already gained the faculty of landing on their feet in personal emergencies before they entered college, and they looked forward to occupation in surveying, topographic work, hydrography, geodetic work, railroad location and maintenance and rough construction work isolated in communities. I am told that a great majority of our undergraduates today are city boys pure and simple. They know Broadway, Beacon street, South Clark street, or Golden Gate Park but they are strangers to the homely arts by which men survive and make life tolerable in the wilderness, and the work to which they look forward involves intricate industrial devices, complicated machinery and involved sociological and political problems.

The first weak spot which I have found in new graduates is inability to apply accurately and quickly their theoretical knowledge to the work which comes to them. It is as though one groped in a familiar forest to find fagots for a camp fiire, and too frequently in the early years the seeker emerges with some ponderous intellectual process for a simple problem which in turn resembles bringing out a sawlog for the fire instead of the twigs that lie all about. This difficulty is well nigh universal. I felt it myself and I doubt if it is curable by college work. In fact, I think college work creates it in a measure. I do believe, however, that it can be much reduced by thorough work. After graduation I spent two years as instructor. I found that the knowledge necessary for me to gain a passing mark in a subject and that necessary to discuss it before a class and to escape the pitfalls set by the members of the class were two different degrees of knowledge. It is my belief that the everyday familiarity which I gained in those two years with Mechanics and Hydraulics particularly, saved me many laborious hours and gave me much intuitive judgment in subsequent practice. I have never known a student who was thoroughly grounded in mechanics who had much trouble with technical problems in practice. I think the same reasoning applies in greater or less degree to all of the subjects which I have designated as "Foundation" and if four years is the only sacred period of time for bestowing a degree, I am not at all sure that some of the 18 hours elective could not be devoted more profitably—not to advanced mathematics or to mechanics—but to a system of problems in those subjects showing the applications of the principles already learned.

Confidence in so-called practical courses seems to me doomed to disappointment. Engineering practice, in the main, is a tedious repetition of a relatively few principles coupled with much study of the economics of the situation. How can a student visualize the limiting circumstances of a practical problem! It is impossible! He would much better spend his time in obtaining a thorough, tongue-end familiarity with his theory, otherwise he will soon degenerate into what has been called Handbook Engineering.

The second weak spot which I have noticed in the new graduate is inability to set up in a clear and logical way any proposition which he wishes to demonstrate. A large part of this inability I ascribe to that lack of thoroughness previously discussed. A boy who races through a wide variety of subjects with the purpose of getting a mark of 60 or better in each one, is in a fair way to get into wool-gathering mental habits and frequently he does not mend even under the active and persistent boot of a boss who wants him to think long and intensely upon a few details. I believe a remedy may be found in concentration upon a few subjects at a time, and intense application thereto until the subject is finished.

A part of this lack of clear expression is due to lack of acquaintance with the English language. There are two inherent weaknesses in written communications—one is the inability of the writer to set down clearly and simply what he thinks, the other is the inability of the reader to grasp clearly what is written. "Grand" writing has no place in engineering compositions. The engineer who finds out how to put all his ideas in words of one syllable will be the model. The clearest writer I have ever known studied the dictionary and a book of synonyms as a diversion.

At the age of 45 I found myself studying Portuguese and Spanish in connection with a business trip to South America and it was a delight to discover that the task was not only a diversion but that it opened up many shades of meaning of English words which I had never before appreciated. I would like to see two modern languages made a requirement either for entrance or for graduation, but not the usual grammar drill. Conversation and translation should be the end sought.

There is not much hope for improvement of this phase in the regular English courses as given in most schools. The first requisite for clear composition is clear thinking and the greatest aid is a definite outline of the proposition to be expounded. Careful study of well prepared specifications and contracts is a valuable exercise. Find out exactly what they mean if you can. Analysis of legal phraseology and of technical reports, with a view to ascertaining whether the language is susceptible of more than one meaning will bring out many new ideas. The standard sought after in one great organization with which I am acquainted is to write in such fashion that the addition of a word will be unnecessary and the elimination of a word will weaken some significant expression. Of course such a standard implies an intricate knowledge of the problem and an intimate familiarity with the state of mind and the intelligence of the man or men who are to be influenced by the document. To bring a problem to students so keenly is obviously one of the great difficulties of teaching. It is probably more valuable to a student to be required to bring a few examples into good form by his own delving than to give him comments upon the defects and remedies of many compositions.

The third weak spot is the inability of the new graduate to apply such checks to his work as to assure himself that it is accurate and constitutes at least one complete answer to his problem. Painstaking, methodical habits are difficult to impose and human minds do not instinctively turn to that sort of thing. Checks and counter-checks usually mean drudgery. Courses in accounting, cost keeping, and the preparation of estimates and bills of materials should do much to help bring an appreciation of the value of accurate work, verified by checks.

A fourth weak spot is the inability of engineers to comprehend and interpret balance sheets, fiscal statements, operating accounts, etc. It is idle for engineers to clamor for recognition as business men until they can use the tools which every business man uses to find out what the condition of his business is. A brief course in corporation and general accounting would help the situation.

A fifth weak spot is impatience and disregard on the part of engineers of their legal and political limitations, duties and privileges. Every engineer should know the elements of contract law and he should have a lively appreciation of the danger of entering upon important business moves without the advice of a first-class attorney. Technical men have not generally been especially good as advisors in labor disputes and they are notoriously poor politicians. It does not solve the problem to say that lawyers, walking delegates and politicians are all crooks. Some of them are not, and most of them can be convinced, or be forced into untenable positions when things turn on questions of right and wrong. Well devised courses in contract law, social science, psychology and business management would open up many interesting vistas along these lines. It is my view that these subjects can be presented best by specialists—perhaps through a series of lectures supplemented by reading, but like Political Economy and Geology, they are likely to be regarded by students as boresome tasks to be gotten out of the way by the easiest process available. Such a frame of mind can hardly be eliminated by routine text book presentation and if they cannot be presented as lively and entertaining subjects palpably applicable to the business of the engineer they might better be set down as reading courses only, or omitted altogether.

Now we might go on this way for some distance further, but I have gone far enough to show that the major tendency in engineering education in past years has been to demand additions to the subjects in the curriculum, and to cut off very few if any subjects.

I call attention to the list of subjects which I have suggested for addition and for convenience shall refer hereafter to them under the general title of "Desirable Additions:"

Machine Design	2
Applications of Mathematics and Mechanics	2
Shop Practices and Shop Production	2
Exercises in Accurate Composition	1
Theory of Accounting	2
Cost Keeping	
Corporation Accounts	
Bills of Materials and Estmates	
Psychology	2
Social Science	2
Business Management	2
Contract Law	3
Modern Languages (2)	4
Total (about)	23

The members of the Faculty know full well that the addition of any subjects to the present schedule at Cornell means dropping something else of approximately equal importance. What one critic would drop another would keep. The five and six year courses which have been outlined at Cornell and at various other schools go a long way toward solving the problem of more hours, and the testimony and accomplishments of men who have taken those courses appear to me to verify the belief that they are well worth while for those who can take them.

The limitation of college work to four years, however, seems to me to rest upon economic necessity and to lengthen it to five or six years would probably exclude many of the worthy young men upon whom the problems of economy press constantly. To require a longer course might be a success as a means of reducing the number of Cornell graduates who enter the profession but it would probably result in a corresponding increase in attendance in schools which continue the four year course.

Now the subjects which I have designated as "Foundation" appear to me to include most of the subjects upon which the usual engineering practice rests and with minor changes they represent about the minimum equipment with which Cornell should be willing to release any engineer into either a further study of the various branches of the profession or into the practising field. In short, I think it represents a sufficient and at the same time a necessary foundation upon which to construct any kind of technical career in engineering. Also it represents most of the subjects which are difficult for a young man to acquire properly by night school work or by private study. On the other hand given this foundation most young engineers thrown into daily contact with actual work will have small trouble—providing they be diligent and persevering —in acquiring practically any of the other work which may be needed.

Of the men who take civil engineering a large percentage go into the first job which offers and stay thereafter in that work. Such a career calls for no special training which can be given in college. Many of them go into contractors organizations where a well disciplined mind is valuable and a wide knowledge of technique is not especially necessary. Men especially equipped mentally as designers are not numerous; competent scientific research men are rare. Both of the latter types should take the longer courses and should be encourgared thereto by the Faculty.

It seems to me, then, that we are in shape to consider several partially alternative propositions—to wit:

1. Can Cornell afford to make the required course for the degree of civil engineer five years instead of four, adding to the present requirements the list called "Desirable Additions?"

2. Is it feasible to eliminate the 18 hours elective in the present course and insert in lieu thereof the "Desirable Additions" list in the requirements of a four year course leading to a degree?

3. Is it feasible to operate the University on the basis of a scholastic year of eleven months instead of nine? If it is feasible the "Desirable Additions" can be added to the present four year course and be completed in four calendar years. I see no strong reason except financial needs why students should lose three months every year. Financial reasons on the part of the University and on the part of the students may make the suggestion impractical.

4. Can the present four year course, slightly abridged, be given in a three-year eleven-month term?

5. Is the following procedure practical? Lay out a course consisting of all the subjects of the present course except those classified as "Applied Civil Engineering." Add to it the subjects called "Desirable Additions." The total will be about 125 hours. Some minor adjustments as to hours and subjects will be required. Give it in three years of nine months each. It will be a stiff course, but men who cannot make it will do well to wonder if they belong in the engineering business. Grant for this not a degree, but a certificate of attendance and completion of the course. Leave the present four year, five year and six year courses as they are with provisions as heretofore indicated for the inclusion of the "Desirable Additions" subjects and grant the degrees now conferred for the completion of those courses.

I believe proposal 5, for a three year cousre will meet the needs of the rank and file of Cornell civil engineers. It will not give that broader culture and wider knowledge of engineering which I have always envied in other men and which I wish every engineer could have but this broader training would take six years in college and I do not believe we can face that demand yet. I do not believe the three year course represents lowering standards nor cheapening the degree provided there is an insistence upon thorough work.

I consider suggestion No. 1 inadvisable.

I consider suggestion No. 2 feasible.

Suggestions 3 and 4 involve sweeping changes in University policy which I do not feel competent to discuss.

Suggestion 5 I believe to be worthy of thorough study by Faculty and Trustees who must ultimately make the decision in any event.

In the Mann report much stress is laid upon the value of co-operation between industrial enterprises and Universities with a view to giving students as much practice in engineering work as can be reasonably obtained during the college period. As expounded in the Mann report and based upon studies of the Cincinnati experiment the plan appears to work out well, particularly for mechanical and electrical engineers. It is possible that some such possibility can be developed for Civil Engineers at Cornell. There are, however, a great many aspects of the case which appear impractical to me. During the period of scarcity of help of all descriptions, I have no doubt that the assistance to be obtained by managers of industries from student help is well worthy of consideration, but it is my judgment that this development in educational work must always rest for its stability upon the economic value of the services rendered. Work in which students in Civil Engineering could be employed is not, in my judgment, so susceptible of manipulation of this nature as mechanical and electrical engineering pursuits carried on in shops and under production schedules extending over longer and somewhat more definite periods of time. In the organizations with which I have been connected it has never been possible for me to say—for example—that on the first day of June I could take on a number of men in office or field work, or that I could with certainty keep them steadily employed until some other designated date. In the summer of 1917, with the tremendous demand which war work brought upon the organization, I undertook to take on 50 men from the colleges at the end of the scholastic year in June. I found the task an inconvenient one and the summer was half gone before the men were in a position to judge if they were adapted to the work, and in the meantime some of them had grown disgusted with the semi-clerical duties to which they had been assigned and had looked up other vocations or had gone away to spend the remainder of the vacation in some other fashion. The problem is not satisfactorily solved by arranging students in squads which displace each other. The growth in utility is so great in any three months of the first years that the candidate is likely at the end of three months or more to have arrived at a status which the new man, coming in to replace him, cannot handle. I have not found much success in keeping students satisfied in routine working positions, such as motormen, firemen, track laborers, concerete workers, or other positions calling for muscular labor. They either work away from it of their own volition or are hopelessly indifferent to the task. I have no doubt of the educational value of such work, but the psychology of the average student has not been such, in my experience, as to lead to the expectation of very large results from such experiments.

An organization of alumni who are following civil engineering pursuits, having specificially in mind the utilization of the services of students through the summer months would, undoubtedly, make some improvement in the situation, and I suggest that the New York Society of Civil Engineers, which is working in conjunction with other Cornell Alumni Associations, is in a good position to give this work the study required and to organize for it in so far as organization can be perfected.

I cannot leave this subject without reference to the Faculty, and in this connection my remarks are addressed solely to the Alumni. Teaching is as much a business as structural engineering or reinforced concrete construction, or railroad practice, or any other phase of engineering work. The men who follow it must work at it with the same energy and initiative and the same devotion to duty which any practitioner exhibits if success is to be obtained. The opinions of laymen, as to teaching methods, are not of very much value and in all that I have said in connection with this discussion I would expect the expert judgment to be exercised finally by the Faculty and by those members of the University Executive Staff and of the Board of Trustees who give such subjects continued and consistent study. The Faculty in the College of Civil Engineering at Cornell display today, in my judgment, the same conscientious devotion to duty displayed by the members of the various Faculties with which we were acquainted as students. They have been underpaid for years past. You and I cannot expect to fill our engineering staffs with desirable men under any such schedules of pay and moreover Ithaca is so located that unless a special effort is made, the members cannot have the inspiration which comes from contact with active commercial propositions. In any event the maintenance of such contact involves not merely the energy to keep it up, but an amount of expense which no member of the Faculty—if their needs in reference to living conditions are similar to mine—can afford. I express the opinion that the most conspicuous service which the Alumni of this Institution can offer is an organized effort to bring the members of the Faculty into contact with engineering practice and keep them definitely in touch. As a practical matter, I see no way to bring this about except for the various concerns which are headed by Cornell men to take on a certain periodic obligation whereby members of the Staff at Cornell are invited to the work, given an opportunity to look into it—not merely in its external appearances, but as to the interesting details by which processes are set on foot and maintained. Such a contribution would be, I am sure, of the greatest benefit to the Faculty and would entail an expense upon the alumni which could not be devoted to any higher purpose. I suggest this enterprise, also, for the consideration of the New York Society of Civil Engineers.

Finally, there is the pressing question of funds. Several years ago Professor Hull pointed out at a meeting of the alumni the fact that Cornell was doing greater work, as to numbers, than either Harvard or Columbia, while the endowment of these two institutions were respectively $22,000,000 and $15,000,000 as compared with Cornell's endowment of about $9.000,000. The engineering alumni of Cornell, so far as my acquaintance goes, are not in a position to increase, from their personal resources, the endowment of the University. By an organized effort, however, I think it might be possible by a series of annual subscriptions—designated for the use of the technical school—to materially ease the situation. This is a practical matter upon which the members of the Board of Trustees could advise. There are approximately 1,800 graduates of the College of Civil Engineering. An average annual contribution of $25 per man would give a fund applicable to the purposes of the school, if it be so designated, of $45,000. I do not regard this as the most acceptable form of financing an educational institution. I have never been an admirer, for example, of the fiscal programmes by which churches are maintained, but such a programme is vastly better than no maintenance at all and I add my small word to the urgings of the officers of the University that we consider this phase of the case and ascertain if aid in this direction cannot be forthcoming in more generous amounts until the affairs of the University, from the fiscal standpoint, are brought into more desirable condition.

THE COURSE IN CIVIL ENGINEERING AT CORNELL UNIVERSITY

By Ralph S. Proctor, '01 and Ezra B. Whitman, '01

A dictionary definiton of "civil engineering" is "that branch of engineering which relates to the construction or care of roads, bridges, railroads, canals, aqueducts, harbors, drainage works, etc." It is evident from this definition that a course of study which in four years' time will entitle the student to place "Civil Engineer" after his name, must be highly specialized. Specialization is every year becoming more and more a necessity for the professional man in every line of work. It will be noted that the definition includes no suggestion of general or cultural subjects. It is merely a framework upon which to build a course of study in civil engineering.

It is the object of this discussion to suggest the best possible course for the College of Civil Engineering at Cornell University to offer the prospective engineer. We must start therefore with the object to be attained The young man who has made up his mind to become an engineer desires a technical college training in order that he may sell his engineering services at a better price than would be the case if he did not receive it. It is the object of the civil engineering faculty at Cornell University to offer a course which will fit the graduate to compete most successfully with the graduate from other institutions offering a like course.

Having before us the field of work to be covered and the object to be attained we can proceed to a consideration of the details of the course itself. From the definition of "civil engineering" it is evident that it is not a question of what shall be offered in the way of subjects, but what can be left out and still obtain the results desired. There are certain fixed limits within which to work which necessitate in the beginning a decision as to policy.

The civil engineering course at Cornell has been cited as an example of an extremely narrow course, that is to say, a course offering highly specialized engineering subjects, excluding almost entirely cultural studies. It is therefore an example of one limit and one well defined policy; the other extreme limit is a course resulting from a policy based on a belief that "the engineering profession is too closely bound up with many phases of human life to stand by itself as a thing apart." The result of this policy would be an engineering course, in which cultural studies formed a very large percentage of the students' four years' work. Its adoption at Cornell would completely destroy the character of the Civil Engineering Course, upon which the college has built an enviable reputation, and turned out engineers for years who have given a good account of themselves in competition with graduates from other engineering colleges.

To illustrate more particularly the limits within which engineering courses have been built, as well as to show the result of different fundamental policies, Professor Tilden of Johns Hopkins University, in a paper entitled "The Course in Civil Engineering" written in 1914, shows graphically the way in which the students' time is apportioned for the four years in six different engineering schools. The studies offered are divided into three groups. first, cultural studies, including English, philosophy, history, modern language, and political economy; second, the scientific preparatory group, including mathematics, physics, chemischemistry, drawing, geology, astronomy, surveying, biology and bacteriology; third, the strictly professional subjects, including shop courses. The graphical diagram shows, of the six colleges, Johns Hopkins University as one extreme, and Cornell University as the other. At that time 24.2 per cent. of the students' time for the four years was occupied with cultural studies at Johns Hopkins as against 2.1 per cent. at Cornell. Forty-one and nine-tenths per cent. at Johns Hopkins as against 40.3 per cent. at Cornell with the scientific preparatory group; and 30.1 per cent. at Hopkins against 57.6 per cent. at Cornell with the strictly professional work.

While the above is interesting as a matter of comparison, our main concern is, which policy makes the most successful engineer? Also, does a broad course in engineering entitle the graduate to the degree of C. E.? It is the writers' opinion that a highly specialized course such as offered by Cornell in the past is desirable, and that the danger today is a broadening of the course to such an extent that it will lose its high standard of specialization, in which event it would not be fair to the real engineer to grant the degree of C.E. upon graduation, giving same only after experience in the field and presentation of a thesis. The latter policy would destroy forever the civil engineering course which has in the past been a large factor in Cornell's world-wide reputation, as a leading engineering school.

We do not mean to say that cultural studies are not desirable. They are most desirable. but a four years' course does not give sufficient time to undertake but a few of those most important to the civil engineer. It is not believed by the writers that a course longer than four years is advisable for practicable business reasons. A longer course would put it beyond the means of a material number of young men limited as to time and money. Further, it is desirable for the young engineer to get out into field work at as early an age as possible, as his study does not cease with the completion of his college course, but must continue as long as he follows the profession, and upon graduation he enters upon a more highly specialized training than he possibly could have in college. It has been truly said that the two essential qualities of the engineer are imagination and faith, and surely the average young man is endowed with these by nature. He should therefore get into serious contact with his chosen life's work at as early an age as possible, that these qualities may be properly shaped to the work in hand when they are most pliable.

If Cornell is to continue to offer a highly specialized course in civil engineering, the next question which confronts us is, first—what cultural studies are most necessary to the engineer, and second—how many can be put into the course and still maintain a high standard of specialization? The engineer, like any business man, has something to sell from the proceeds of which he makes his living. His plant of production is his brain. It makes no difference how well he has prepared that plant for production or how excellently made his machinery, he will starve if he cannot market his production. His degree of success in life is marked by his ability to give expression to his engineering ideas. Engineering ability and ideas are manifested in three ways: by drawings, by word of mouth and by writing. These are the three and the only three channels through which the engineer may display his wares. Those who can accomplish this in the most attractive and convincing manner will make the greatest success of engineering. Therefore, an engineering course is lacking a very necessary fundamental that does not provide the student with the means of placing his wares upon the market.

It is not considered necessary to dwell upon the course offered by Cornell for the expression of engineering ideas by drawings, as the writers are convinced from long experience that drawing as taught is well conceived and executed, and should fill the students' every need after graduation.

The position which the engineer held in the business world fifty years ago, when Cornell was founded, was far different from that which he holds today. Then the idea that the engineer should be connected in other than a subordinate capacity with great public enterprises was scouted. About thirty years ago a conservative Boston newspaper made this editorial statement: "The place for the engineer is not on the commission but on the payroll." Today the large percentage of the requirements of our highly organized domestic and business life call for the engineer specialist, due to the rapid broadening, during the past quarter of a century or so, of the scope and influence of the professional engineer. The time is here when he must be the creative, constructive and operative head of many institutions upon which the health, safety and comfort of our daily life depends. To take this position he must be prepared, and able to express his engineering ideas clearly and convincingly.

It is felt by the writers that we would have been better equipped had we been more thoroughly grounded in the use of English both written and spoken. Just as soon as an engineer reaches a position of responsibility, he is called upon to write reports and these reports should be written in plain clear English setting forth very plainly and clearly the subject matter of the report. Then he is also called upon to explain before Boards of Directors, City Councils, and also before public meetings, various engineering works.

The engineer really has a great deal more to do today in the successful administration of a municipal government than have the men of any other profession, yet it is the lawyer in the great majority of cases who directs public opinion and who is consulted in regard to public improvements and whose opinions are sought by the public at large on most municipal questions. In the city of Baltimore, for instance, engineers head the following departments: Water, Sewerage, Topographical Survey, Subway (in charge of underground subways for electric wires, telephone wires, etc.) Street Cleaning, and the Paving Commission. The only departments in the city which are not headed by engineers are the Tax Department, Legal Department, and the Finance and Accounting Department, represented by the City Comptroller and the City Register.

The voice or the opinion of an engineer is very seldom heard in Baltimore regarding any public question while lawyers give their opinion both verbally and written, by the score. The reason for this is that the lawyer is taught to write and to speak while the engineer is taught rather to act than to be accomplished in writing and public speaking. This means that the engineer is the servant while the lawyer is the master who directs the work. There is no reason why this should be, and it is believed that if the engineering courses in our universities thoroughly grounded the students in the use of English, both written and spoken, that the influence of the engineer on public questions would become infinitely greater than it is now. We believe that English (both written, and public speaking courses) should be carried through practically the entire four years of the engineer's course. Teach the engineer to put his thoughts clearly on paper and teach him to think on his feet and clearly speak his thoughts, and you will have tremendously increased the influence and value of the engineer to the public as well as to himself.

We also believe that the engineering course should give a much more thorough training in specification writing and contract law. Practically from the beginning an engineer is called upon to interpret specifications of others and, as his responsibilities grow, he is called upon to draw contracts and to write specifications. This work could be carried along with a parallel course in Engineering and Contract Law, which would bring out practical illustrations of the uses and abuses of engineering contracts and specifications. Engineers are prone to either interpret contracts and specifications absolutely literally and always in favor of their clients, or on the other hand to look upon contracts and specifications more or less as scraps of paper. Engineers should be taught that justice and equity is or should be the basis for all contracts and that no one-sided contract or interpretation of the contract will stand at law.

In addition to the above studies it is suggested that a course in business principles be given, including methods of underwriting and financing engineering developments, as well as accounting. In this course the student can be given some idea of the value of engineering services, and business methods of entering into contractural relations with clients. Into this course, might be interjected a certain humanizing element of which the average engineer is sadly in need. When we were in college, Dean Fuertes gave a course of lectures to the seniors, called "Sanitary Engineering." We do not recall that he mentioned any matters pertaining to Sanitary Engineering during the entire course, but he tried to teach us that in being engineers we must also be human, and that the world and our own success demanded that besides knowing how to design bridges, railroads, sewers, water supplies, etc., we must know how to eat, dress, live and vote, as well as how to mix with our fellow men.

It is understood that a great deal of time and thought has been given by the faculty looking towards keeping the College of Civil Engineering in its long maintained position as a pioneer school of the highest standing. We believe this will be accomplished by continuing to offer a highly specialized course from which a high standard of work is exacted. In addition to this, emphasis should be laid on English and public speaking. These, to be effective, must be designed by the faculty of the College as they are the best judges of the necessities of the engineer in these particulars. Additional stress should be placed on the study of specifications and contracts, with as much contract law as time and the relative importance of this subject will warrant. A course in business as outlined would be advisable.

In closing we desire to make a suggestion which does not affect the kind and number of courses offered, but will have much to do with placing the College at the front of engineering schools. We believe that the conscientious efforts of the faculty have maintained a course which is turning out real engineers. The course and facilities have great potential merit, but the public is losing sight of this fact. This is due to the increasing number of good engineering schools all over the country, especially state institutions, which have unlimited means and are advertising widely. The College of Civil Engineering at Cornell must advertise. The State ,and manufacturers of engineering materials should be encouraged to use the talent and facilities at the College for engineering investigations, reports and testing of materials, and equipment. Such work will bring the College to the front and place it where it really belongs, with its present talent and equipment, and make it easier to obtain additional facilities. It will be of tremendous value to the student and faculty alike. The public will then learn of the real efficiency and capacity which is now possessed, and it will raise the spirit and interest of all connected with the College by closer intimate touch with practical outside engineering problems.

PAPER READ BY J. A. KNIGHTON, C.E., AT THE COLLEGE CONFERENCE OF THE COLLEGE OF CIVIL EENGINEERING, CORNELL UNIVERSITY, JUNE 20, 1919.

So much is being said and written in these days about Engineering education, principally by Engineers themselves, that one naturally inquires into the cause of it.

Before the present War, the Engineer felt that his ideals were not being realized, that he was capable of rendering more important service than he was called upon to render; that while it was expected of him to draft plans, he was seldom asked to draft policies.

The important part which Engineers have played in the war has tended to accentuate that feeling. Someone has said that it is a million years since 1914. Our conception of citizenship and our breadth of vision have expanded in that time, and increasingly the Engineer has been reaching out for bigger and better service.

In his analysis of the question of the present status of the engineer, he naturally scrutinizes the foundation work: Engineering Education. Now all the ills that the engineer is heir to, cannot be charged to his education. It is the proper function of Engineers and Engineering organizations to correct some of them. Others are doubtless beyond control and are due to the nature of the profession.

Mr. Philip N. Moore, past president of the American Institute of Mining and Metallurgical Engineers, recently called attention to some of the adverse conditions which tend to affect the civic usefulness of the Engineer. Among these he mentioned:

(1st) Lack of local attachment owing to necessary changes of residence.

(2d) The fact that so large a proportion of engineers are employed by great business consolidations, which have interests adverse to the public, or by their very size induce criticism and political attack; so that in self defense they think they must hold their staffs to strict neutrality on all public questions.

The fact remains, however, that engineering curricula are being scrutinized and dissected as never before, and I have a profound feeling that it is due to a commendable desire on the part of engineers for bigger and better service in world work.

Education should be a means to service, not of escaping it. Aristotle has stated the purpose of education to be:

"To make the best possible man out of any one individual, to make the individual the best man that he can be."

The student entering college has, or should have that ambition, and he has a right to expect a training to that end. In other words, the students' future should be the aim and end of his education.

Sometimes we hear him spoken of as a commodity,—"Tell us what you want"—says the producer,—"and we will try to furnish it." The employer is making an investment, and too often he influences those responsible for the curriculum to include or add such courses as will make his investment a profitable one. It does not matter so much what salary the engineering graduate receives, or what his title is on his first job after leaving college. The question is: What will they be in five or ten years?

The Engineering profession is young and is still in a state of flux. Not so long ago, an Engineer was either a Military Engineer, or a Civil Engineer. Now, judging by the curricula of the schools, an engineer can only be properly classified when we know his family, genus and species. Dr. Mann in his able report has shown that twenty-eight specialized branches of Engineering are taught in American schools today.

Frederick Bass, Professor of Municipal and Sanitary Engineering, University of Minnesota, in a recent paper on "The Relation of the Engineering Profession to Engineering Education," says:

> "The general assumption among engineering educators is that engineering is almost entirely a technical pursuit, that its foundation lies in an understanding of the forces of nature, and their mathematical expression. Observation of engineers' work indicates that in a great majority of cases this assumption fits the facts, and that it will continue to do so to some extent; but the conception of the engineering profession which is taking form in the minds of thousands of engineers is a much greater and higher one, and the curriculum must conform, and will, when engineers definitely demand that it be done."

Further he says:

> "The engineering curriculum must provide the student with a thorough grounding both in the fundamental principles of natural law and of human institutions."

Mortimer L. Schiff has said:

> "The world war has shown us how important it is that an educational policy be adopted to train our young men in thoroughness, efficiency and breadth of vision."

The wise planning of a curriculum requires a knowledge of present conditions, and a vision of the future, that is undimmed by either precedent or fad. I shall not attempt it here, but merely call attention to some of the features which I believe to be essential in the regular course in Civil Engineering at Cornell University.

In my judgment the course should be liberal in character, with some work in mechanical and electrical engineering, including shop work.

The time may come when such a course should be five or more years in length; but for the present I would recommend no change from the present four year's course. In a course of that length we cannot produce specialists, we can only build the foundation. Cornell is and should be prepared to train specialists, but such training should come after the regular course and be taken by those who have a very definite idea of their life work.

If statistics were available, it would probably be found that less than fifty per cent of the graduates in Civil Engineering follow the particular and limited field that they pictured in their undergraduate days; and again most practicing engineers find their work requires knowledge in mechanical and electrical engineering as well.

The latter is especially true of those who attain eminence in the profession.

Professor Marx in speaking of Leland Stanford University says:

"We realize that all we can do in four years' time is to ground our men in the elements of the profession, and this grounding must include some work in mechanical and electrical engineering."

Fundamentals

I think that most of you will agree with me that there should be a thorough grounding in the fundamentals. By fundamentals I mean such tools of the engineer as: Mathematics, Mechanics, and Physics, which do not change with the years, no natter what changes may take place in Engineering practice. As far as may be, such subjects should be taught at the same time that the student is learning their application.

English

English both oral and written should have a prominent place in the course.

The subject might well be taught in conjunction with most any engineering subject. For example: Let the student prepare a paper on an assigned subject, and present it before the class in the same manner that he may later present a paper before the American Society of Civil Engineers. Encourage a freedom of discussion on the part of the class and then rate the student's English on his written paper, on his oral presentation of the subject, and on the manner in which he meets criticism, by his fellow students:

Professor Fuertes used to say that the engineer should be able to stand on his hind legs and talk. It is generally agreed, however, that as a rule he is not able to do so in an acceptable manner, and that therein lies one of his weaknesses. The plan outlined would tend to overcome that weakness and has the advantage of teaching English as the engineer uses it. It is safe to say that it could be applied to anyone of several engineering courses without impairing the teaching of the subject matter of the course.

Humanities

It has been said that:

> "The engineer's training, too often being merely technical, has failed to teach that the greatest task of all is the ability to persuade men."

As an antidote, such subjects as Logic and Psychology should have a place in the general course under consideration.

Broader Commercial Education

On March 31, 1919, a committee composed of twelve prominent educators from well-known technical schools and one representative from each of the four national engineering societies, met in Washington, D. C. to discuss ways and means for the broader education of engineers along commercial lines. After a general discussion, through the better part of two sessions, it was found that the Committee was of the unanimous opinion that certain business courses should be added to all engineering courses in technical schools, in order to give the engineering graduate some knowledge of business, particularly emphasizing the questions of Cost Accounting, General Economics, Specifications, and Contracts and Business Organization.

The representative character of the above committee indicates the general demand today for a broader engineering education.

Engineering Subjects

That there must be such courses goes without saying, and to the fullest extent possible, they should be taught in a manner to develop the initiative and resourcefulness of the student.

Engineering practice is constantly changing. The student must be made to realize this. Problems should be assigned to him of such a character that it will be necessary for him to make his own assumptions and draw his own conclusions.

His time should not be so filled with absorbing facts and conclusions arrived at by others that he has no time to think.

A recent questionaire sent to twenty experienced teachers, in some of our best known technical schools asking for opinions as to the hours a week that should be required of an undergraduate student in engineering

—including time spent in class, drawing, laboratory and study—brought replies ranging from 46 hours to 54 hours. The avergare was 50 hours per week.

The above would seem to indicate a modern tendency to exact less time from the engineering student on assigned work than formerly. This means shorter assignments and shorter assignments makes it possible to exact a more thorough knowledge of the work covered, which is desirable. But someone will say: "You must remember we are discussing a four years' course, the course is crowded as it is." There is no apparent reason except precedent, why the college year should be one of nine months instead of ten. Excellent results are derived from the Summer Survey Work which has so long been a part of the course—largely owing to the concentration on one subject.

The same plan might well be followed at the end of each of the first three years of the course, and would provide ample time for all the necessary shop work and surveying, as well as much of the drawing.

A thorough co-ordination of the several subjects in the course is not only essential for its welafre, but will serve as a time-saver as well by avoiding duplication.

Today trade and technical schools are training students in surveying and drawing, and it would appear that the time is ripe to recognize that as their field; and to hold a higher conception of the aim of Civil Engineering education at Cornell.

Not all of our students will attain to the higher positions in the Engineering world, and some who enter the course might better have taken up some other pursuit. On the other hand, certain pupils show unmistakable qualities for some special branch of the profession.

Has the student ability for teaching, for handling men, for research; or is he destined to become a surveyor or a draftsman?

Usually his teachers know in a general way, and it would be better for all concerned if the students' qualities—other than his book knowledge—were periodically recorded and transmitted to him.

The introductory lectures provided in the present curriculum, are worthy of commendation, and might well be supplemented by addresses by men eminent in engineering or in some allied field.

James A. Garfield once said:

> "My idea of a University is Mark Hopkins on one end of a log and a student on the other."

After all, the inspiration of the teacher counts for so much that the curriculum pales in comparison. Cornell owes her greatness today, to the lives of such men as Fuertes, Crandall, and Church, and with their ideals, perpetuated, the School of Civil Engineering and the University can confidently look forward to the future.

INFORMAL DISCUSSION OF PAPERS PRESENTED AT COLLEGE CONFERENCE

Prof. Irving Porter Church, '73, Emeritus, Presiding

Thomas S. Clark, '04:

If there is anything the matter with the course of civil engineering that our beloved professors have been giving to students for the last twenty-five years, if it is a fact that it lacks the cultural subjects, that fact has not been demonstrated by the two scholarly reports that we have just listened to. If it is this it lacks to make it a success, then it needs no change at all.

Not long ago a friend of mine was introduced to Professor Church and afterwards he asked me this question: "Is Professor Church an engineer? He talks too well; he could sell me most anything." Now I believe that just that point is what these two gentlemen are trying to bring out, that a man needs, not only an engineer needs, but a man in any profession. A man might have the best solution of a problem; he might have the best scheme, a financial scheme or a building scheme, or any other kind of a scheme, but if he could not present it to the man on the job, the man whom he chooses to put it over, he had better not have any scheme at all, or go out and hire somebody to present it for him.

There is not, as these two gentlemen have said, time enough to give those subjects that usually fit a man to deal with great big problems and meet men, but I am going to say this: If the professors could arrange what has been suggested,—and I believe a great many of you agree with just what has been suggested,—we can't wish any more. If they will just give enough to the students to plant a seed for the taste of the cultural subjects, they have gone a good ways. A student says, "I want to study geology. What do I want to study logic for?" That is very natural. My classmates felt that way. But if enough could be given, as I said before, to plant the seed or the desire for subjects that are not purely engineering, I think the professors would have gone a great ways. As Professor Church said, "Brevity is the soul of wit," so I will close, I thank you.

R. B. Goodman, '94:

In the first place I want to criticise Professor Church. I have waited twenty-five years for a chance. Of his students he counted me out of the engineering profession and the engineering profession is my greatest hobby, although I am not an engineer and I could not link lumber with my engineering training. So let us take some of those business men off the ineligible list and put them over on the professional side. I have just a little word for the dentist too. I want him to come over onto the professional side because he points a moral. I had some bridge work done for which the dentist figured out on his engineering ability alone an actual cost of no less than $216 a lineal foot.

A necessary qualification for an engineer is salesmanship. This is my idea of salesmanship, that it is rather a subject which we should put on that list, and I am sure it is a tint that colors the whole curriculum. My definition of engineering is to do with one dollar the work that an ordinary laborer would require $4.00 to do. If the members of this profession were getting the work properly done $3.00 would have been saved. I don't think they are getting their share of this. I don't think that the engineering profession has been interested, self-interested as much as it should be. I think it has been the goat. I don't feel that the professional man generally does get what he is entitled to; experience in the past has taught us that.

I want to say that all three of the talks are with the idea of training the engineer to self-service, first to mean service to himself, then he is sure to get what he should.

I do not look at the engineering course as a course; it would be impossible to make it a course in four or five years specialization. Specialization has got to be now a course of ten years in any profession. The applications of engineering, taking 39 hours—29%, constitute merely a series of openings, merely a series of windows through which we look. It seems to me we could crowd those desirable additions into some of the work in the application of engineering.

There are two classes of engineers,—there is the busy bustling type of the man that specializes all his life and there is the commercial type of engineer. . . Proper relation of all the branches of engineering fits any commercial problem which has its place in the world, and by this sort of a compromised course you have turned out a man who can choose work for which his education does fit him and can decide on life specialization or keep the general engineering mind as I have tried to do myself.

Colonel Henry R. Lordly, '93:

My experience and success since leaving this good institution covers a period of twenty-two years of actual engineering experience, some in the United States, many years in Canada, several in England, Scotland and Wales, almost five years active military service including three years overseas during this war, only winding up a few days ago.

The papers that we have listened to I think are noteworthy, but I will admit do not solve the problem from the standpoint of a man who has been away from his Alma Mater, like the speaker, for twenty-five years.

I am not an old man, but I am old in experience, and I do not forget the words which Professor Fuertes gave me when I entered the old building in 1889. He said this: "We do not pretend to make engineers here. We can give you a fundamental training whereby if you have the makeup you may become an engineer, but we cannot make you one." And the best proof of his remark is the fact that among graduates you have turned out at least five ministers of the gospel, whether they knew much about heat engines or not. It reminds us of the words of our late Dean, "that he culd not make you what the Almighty had a right to make of you."

To comment briefly on the remarks made by these gentlemen who have so kindly studied your curriculum, it would appear to cut down the course here, to give a man some kind of a certificate whereby he could go out into the world and state that he comes from Cornell University after three years training would be a crime against the institution and against its faculty. You could not take, from my experience, the brightest youth that ever lived and pass him through this institution and put him out to be anything better than a common laborer if you limit his time to three years.

I believe your best course today is to maintain the standing of this college, not by headings to your curriculum and syllabus, but by the name of the professor who stands for the heading of that curriculum. I would no more consider a course in applied mechanics or mechanics of engineering without the name of Church after it than I would consider going to some college where mechanics was not taught at all. It is the name that must carry. If you take railroad engineering when you come to the point of obtaining a professor to take the place of our beloved Professor Crandall I believe you will find it a big task to select a man who will go down in the history of Cornell as he did. Cornell University has a standing not confined to the United States. See that that high standing is maintained.

Let me answer for you from my training and experience the following questions:

1. What features of the curriculum have graduates found most helpful in their work since leaving college, and what additional features or substitutions would they have been glad to have?

Personally, I have found no deficiencies in the curriculum. Any deficiencies that existed existed in the man who walked out of here with the degree in his hands and who perhaps got through with a very low mark. Those deficiencies will soon be recognized by the graduate and it is his duty to correct them. The writing of specifications, letters, etc. and presenting them in good form can be obtained only by practice, but I myself gained most of my knowledge from instruction by Professor Church when he taught us to make our reports, etc., in accurate and neat form.

2. Influence of war experience on future teaching of civil engineering.

I speak only as one who has had a good many years of experience in military engineering, five years of almost constant military service including three years of constant experience overseas, and my experience teaches that the purpose of military engineering is to get through in the shortest possible time, regardless of cost or expense or any sacrifice. Now you gentlemen know that you cannot do that in civil life. So personally, I believe that beyond the training of quick-thinking, and quick-acting, there is nothing to be gained from war experience as it concerns the curriculum of this college.

3. The subject of "City Managers" in general, and whether the undergraduate course should have special features bearing on this kind of work.

I know but little about this subject, being too long overseas to know much about this new subject. The only thing to guard against there is that insidious invasion of politics which I believe exists not only in all of our cities overseas, but in this country.

5. The Art of Dealing with Men; and whether anything might be done in the curriculum to inculcate or develop this art.

This subject is something that cannot be taught here. I know from actual experience in handling men from Russians, Italians, all kinds of aliens down to the Britisher from the north of England that tact is the sole requisite. You must take your men and your foremen and study them, be a friend to the man you employ, don't antagonize him, but win him over, take to him warmly, go out of your way to win his heart, but do not antagonize him. There is nothing in this course in the university that will help you in this respect. It requires tact, and you can't learn that in a university course. Tell that man working for you that what you want him to do is of interest not only to you but to himself. I thank you.

Rodriguez, A., '91:

I am very proud to say that I have been a practicing engineer for twenty-seven years. My first year I worked for nothing getting experience. I received my first job through a Bureau. I have found in my practice that the course I took in Cornell at that time has been quite efficient, especially the fundamentals. I found that only one thing is lacking and that is a little course in public speaking. Perhaps the reason I found that difficulty is that English is not my native language. I believe that every one should be given a chance to specialize, in language for one thing, especially the language of the future, Spanish. A great deal of engineering in Central and South America makes a knowledge of Spanish necessary.

Gerardus Harrisson, '10:

I have been much interested in this subject of engineering education by the address of Dr. Mann in New York and because the partner with whom I am associated is very much interested in the subject.

It seems to me from my own experience in the engineering vocation outside of Cornell the most important years are perhaps the first five after we have received our diploma and not the four which immediately precede. I have very pleasant memories that I took up civil engineering because of the fact that a cousin of mine was going to take civil engineering. Some inefficiencies from the point of the engineering education I received I remember distinctly, but I did not come up against any problem which the training I received in the engineering college would not help me solve. My drawing experience helped and a little arithmetic.

I think it would be a wonderful thing to help the young engineers by definite talks before they graduate for business so they can get a better idea of where the profession leads to. The point I would like to make is the help in connection with developing real engineers that the university could be to the young graduate during the five year period immediately following his graduation. If the graduates could perhaps before even they know what their jobs are going to be get together with the college or some organization of the college and with them have pointed out what in the profession would help them in their outside work I think it would be a great help. If students could have relations with the university after they are graduated, write in from time to time, know that the university is concerned in them, it would be a big help indeed.

So far as the course of study goes, I am satisfied in my own mind that a very small percentage, perhaps 5%, start right of the graduates in on specialized work. They don't know enough. They have been spoon fed, have followed a regular course of study, have had everything handed to them and as soon as they start in business they don't know exactly what the next step is. Teach the student of engineering subjects which deal with what the profession means, what the line leads to, so that when he commences to become an engineer he knows what to do.

W. Beahan, '78:

Mr. Chairman, Dean Haskell and fellow Cornellians: I regret the lateness of the hour. I will try to make my remarks as brief as I possibly can. I supposed that I was coming here to talk to you upon the handling of men, as to whether or not anything could be done toward teaching that art at college. As a foundation of what I have to say I wish to quote the dictum of George Stevenson, who has been called the father of railroads, who built the first successful locomotive. These words of Stevenson were at the close of his life. Said he, "The most difficult and at the same time the most important branch of engineering is the engineering of men." Now Stevenson didn't say that because of greater wisdom, but because he was in at the beginning. He was not a specialist, he was a genius. He not only built the locomotive but he built the road on which the track ran, the bridges which carried that track, hired his own foreman and got in the game early and therefore he had a broader vision I think than you. . . . Regarding instruction in handling men study in our colleges will help. We should study mental science, political economy, but I am in favor of psychology of a certain kind, especially mass psychology. If you have succeeded in handling a traffic squad you have taken a rudimentary course in the handling of men. If you learn team work in athletics you have learned a good deal in the handling of men. If you try to handle men or to teach the handling of men from what you have studied in a book you will fail. Professor Crandall was a great teacher of field practice; he was a natural field man, you will all admit that. . . . Study what you can here along the line of psychology and then practice it. No use to expect a man to teach the art of handling men who has not handled men extensively and successfully himself. . . . Some personality is required in the handling of men.

Fundamentals which one will need to bear in mind in the handling of men are these: the square deal; Moses laid down the law and Roosevelt rediscovered it. "Do unto others as you would have them do to you." Be square. Don't be afraid. Don't try to stop a riot. Study your fellow men.

IN MEMORIAM

Henry Gregory Northrup, C. E., Class of 1874

Died at Brooklyn, N. Y., October 14, 1919

Henry Gregory Northrup, who was graduated from Cornell University in the Class of '74, died Tuesday, October 14, at his home, 152 Gates Avenue, Brooklyn, N. Y.

Mr. Northrup was born in Ithaca, August 10, 1854, a son of John and Louise Abigail Gregory Northrup. He entered Cornell University after graduating from the Ithaca Academy. He received his degree as a civil engineer, but entered the employ of the Tompkins County National Bank, where he remained for six years.

In 1881 he went to New York and took a position with Ivison, Blakeman, Taylor and Company, publishers, remaining with them until they merged into the American Book Company, when he continued in the employ of the latter. He retired from business three years ago.

Mr. Northrup leaves three sisters, Mrs. G. L. Bontecou of Emperia, Kan., and Mrs. Lewis K. Thurlow and Miss Jennie Northrup of 152 Gates avenue, Brooklyn, N. Y. He was a member of the Kappa Alpha fraternity and of the Cornell Club of New York City

Key to 1920 Class Photograph

First Row (left to right)

1. Fisher, H. S.
2. Sorokin, M.
3. Tang, C. L.
4. Hartmayer, H. W. K.
5. Urquhart, L. C.
6. Seery, F. J.
7. Haskell, E. E.
8. Barnes, F. A.
9. Dennis, O. W.
10. McDermott, T. C.
11. Munisteri, P.
12. MacBean, J. P., jr.

Second Row

1. Wallace, A. V. D.
2. West, R. C.
3. MacKellar, G.
4. Lamoureux, V. B.
5. Neafie, W. O.
6. Needle, J.
7. Manchester, W. O.
8. Van Valkenburg, P. I.
9. Hirsch, E.
10. Engel, S.
11. McLoughlin, V.

Third Row

1. Christian, J. H.
2. Fishman, B. H.
3. Steele, E. W.
4. J9seph, L. W.
5. Hunkin, A. E.
6. W9odruff, C. C., jr.
7. Kn9wlt9n, G. E., jr.
8. Ruhl, D. A.
9. Cook, J. R.
10. Schempf, R.
11. Grantz, W. A. H.

Fourth Row

1. Clapp, R. V.
2. Spivak, W.
3. McGrath, F. I.
4. Smith, J. E.
5. Benisch, H. J.
6. Harrison, B. J.
7. Fay, A. L.
8. Williams, G. C.
9. Ducasse, V.
10. Bowles, R. B.
11. O'Brien, E. F.

Fifth Row

1. Fitzpatrick, P. E.
2. Cormack, C. M.
3. Smith, A. J.
4. Van Camp, P. M.
5. Baier, N. H.
6. Jones, H. H.
7. Cochrane, T. F.
8. Fritz, E., jr.
9. Andrews, W. A., Jr.
10. Linnell, H. H.
11. Eisner, B.

Sixth Row

1. Duffies, E. L.
2. Johnson, B.
3. Lord, G. W.
4. Hungerford, S. H.
5. Fertel, A.
6. McClatchy, J. B.
7. Collum, T. L.
8. Hasbrouck, C. J.
9. Cohen-Contin, J. E.
10. Lallou, G. E. S.
11. Ivanek, kB. B.
12. Koehler, J. H., jr.

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EDITORIALS

The Course in Civil Engineering

The Civil Engineer publishes in this number the papers presented at the Semi-Centennial College Conference by prominent and successful alumni who had undertaken by request a careful and somewhat detailed study of the present course in Civil Engineering at Cornell. In the light of this study and the experience of their own engineering practice these alumni constructively criticized the course as it now stands and offered various suggestions for improvement involving both radical and minor changes. The alumni, the faculty, and the students of the College owe a debt of gratitude to the men who gave their attention to the improvement of the course in Civil Engineering at Cornell, and whose reports are herein presented.

The present four-year course is very obviosuly a compromise between the pressing demands for expansion and for the development of a broader and more comprehensive course on the one hand, and the urgent need, on the other hand, for the accommodation of students to whom a longer course would appear financially impossible.

To meet these economic considerations Mr. I. W. McConnell, '97, would lay out a course consisting of all the subjects of the present course except the eighteen hours of electives now required and the following, which might be classified as applied civil engineering subjects: Railroads, Bridges, Concrete, Water Supply, and Municipal Sanitation. To this he would add approximately twenty-three hours of "desirable additions" to all present courses, to include Machine Design, Shop Practices, new business courses, Psychology, Social Science, and Business Management. Mr. McConnell would give this course in three years of nine months each and upon its completion would grant not a degree but a certificate of attendance and completion of the course. Mr. McConnell also suggests the substitution for the present eighteen hours of electives the courses included under "desirable additions."

It is at once apparent that both of these suggestions involve very radical changes, and that the first at least would have very definite advantages. In the case of the three-year course it would be essential that it be clearly distinguished between the three-year certificate and the four-, five-, or six-year degree and that there be a rigid insistence upon thorough work. This three-year course would certainly make possible for a large number of worthy men to whom it is now impracticable three years of college training in a technical school whose prestige would be sufficient guarantee of the value of the course. It would seem that little would be gained by substituting for the present eighteen hours of electives in the four-year course the so-called "desirable-additions" since in many cases these are already the courses which are being elected and in other case there are special reasons for electing other courses.

The ultimate aim of all courses must be to meet the real needs of the maximum number of students. With this in mind it would seem that a thorough investigation of the possibilities of Mr. McConnell's suggestions in respect to an eleven-month scholastic year would be profitable. This would be either a three-term or a four-term year, and it would adapt itself to the needs of the men who want to take the regular four-year course in three years, the men who care to spend, as at present, four years in taking the four-year course, and the men who desire to complete a somewhat more extensive course in four years. It would furthermore make possible the completion of the present four-year course in four years and at the same time allow a man, rather than several short intervals, from six to nine months of continuous practical experience in the middle of his college course.

There is a growing sentiment that college men who are in earnest cannot afford to, fritter away three months of the year and that they would be wise to spend at least two of these at college or combine two or three of these vacations and spend this time gaining first-hand knowledge by practical experience. A three or four-term, eleven-month year would make this possible. Should Cornell not be in the vanguard with the colleges which have already instituted this change?

Engineering Work in Base Section No. 1

We are particularly fortunate in having for this issue an article on "Engineering Work in Base Section No. 1, A. E. F.," by Col. W. G. Atwood, '92. Col. Atwood was Commanding Officer of the 17th Engineers, and served in the capacity of American Transport Representative on the Supreme Economic Council. He is at present Technical Adviser for Serbia. The article herein published was given as a talk before the Association of Civil Engineers, December 8. After speaking interestingly of the problems which confronted American Engineers in France and were solved by their resourcefulness, Col. Atwood drew from the war experiences some most valuable lessons. He said that the success of the American Engineers was due in no small part to their ability to make use not only of their own experience but of the experience of others as well. The engineering profession offers an unequalled opportunity for service and service is the solution for many of our present-day labor and industrial problems. We are very glad to be able to present Col. Atwood's splendid talk to our readers.

Help Us Grow

The College of Civil Engineering is sending out to five hundred graduates who are not subscribers to THE CIVIL ENGINEER but who are loyal alumni and are interested in the welfare of the College the December number of THE CIVIL ENGINEER. This is done to bring to the attention of these alumni the proceedings of the College Conference held during the Semi-Centennial Celebration last June. A perusal of the papers presented at the Conference cannot fail to stimulate the interest and thought of the reader regarding the deficiencies of engineering education in general and of the course in civil engineering at Cornell in particular.

This action on the part of the College will also serve to bring THE CIVIL ENGINEER to the notice of a large group of non-subscribing alumni It is the aim of THE CIVIL ENGINEER to serve as a link between the C.E. alumni and their College, to keep them in touch with each other, and to serve as a medium for the exchange of their ideas and experiences. Among the authors of articles appearing in this year's issues have been:

Col. W. G. Atwood, '92, Capt. Weston Gavett, '11, Professor Henry S. Jacoby, J. A. Knighton, '91, I. W. McConnell, '97, Professor Clark S. Northup, '93, (A.B.), Professor H. N. Ogden, '89, Lieut. Col. R. F.

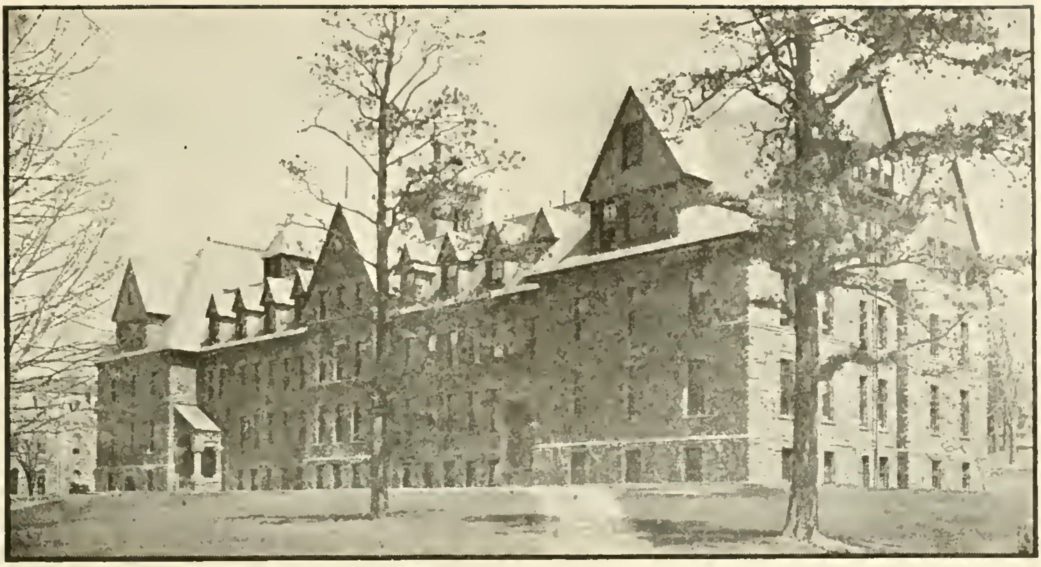
Proctor, '01, Gustave J. Requardt, '09, Dr. E. W. Rettger, C. S. Rindsfoos, '05, Maj. E. B. Whitman, '01, and Chester G. Wigley, '07.

To mention these names is to indicate the high standard of the articles THE CIVIL ENGINEER has this year published. Lack of space has restricted the number of alumni notes in this issue but it is our intention to feature this department.

The publication has grown twenty pages in three months. A still further enlargement which will make the magazine of standard dimensions and therefore far more attractive to national advertisers is contemplated and will be made in the near future if the continued support of our alumni warrants it. THE CIVIL ENGINEER is *your* magazine. Give it *your* support. A blank is provided on the opposite page which filled out and sent to us will put you on our subscription list or, if you are a subscriber, will classify you with the alumni who are putting THE CIVIL ENGINEER to the fore among American technical school publications.

Service Number Questionnaires are now being mailed to all graduates of the College or former students who are known to have been in service. From the data obtained from these a complete record will be compiled and published in one of the Spring numbers. Kindly fill out your questionnaire completely and return it promptly. It is planned to include in the Service Number photographs and records of the men who died in service. This issue will be mailed to regular subscribers and additional copies may be had from us at one dollar. It is essential that we have your order in advance of publication.

I hope for the time when the spirit of engineering as found in practice will form a more definite part of engineering education. This, I think, must come through the professor keeping in close practical touch with the engineering world. There are various ways in which this may be accomplished, but I know of none better than by each professor doing a reasonable amount of practical work for commercial purposes. Under some conditions, this may be consistently accomplished during a portion of his time, but I am inclined to think that eventually our professors will devote all their time to instruction while they teach and go periodically into the world, a few years at a time, for practice. Thus the professorial life would not be so exclusively educational, and our growing engineering institutions may be enabled to enlarge their faculties by the devotion to teaching of a portion of the time of men who are primarily engaged in commercial work.—*Kerr.*



COLLEGE NOTES

Cornell 33
Niagara 22

The Varsity Basketball Team captured its third consecutive game on December 16, when it gained a hard-fought victory over the Niagara University five. The game was slowed down considerably by the numerous fouls called against both teams; in this respect, Porter showed good form for the Varsity by making eleven goals in fourteen attempts. Captain Molinet played his usual good game at left forward, although he scored only one goal from the field; Bastain, at right guard, led in field goals with a total of three, while at the same time, he held his opponent, Captain Quinn, to two field goals.

There was no sensational playing at any time during the game, but, during the second half especially, the teamwork of the Varsity showed to good advantage and there were very few attempts at long shots from the field On the other hand the team repeatedly carried the ball the entire length of the court by a series of passes, getting the ball to within easy striking distance of the goal. That they failed to score oftener from the field was due to the effective blocking by the Niagara five, and to the numerous fouls called.

Basketball Game with Hobart

On December 11 the Varsity basketball team won the first game in a one-sided game, with Hobart which resulted in a score of 57 to 6. Better basket-shooting and teamwork won over the slower Hobart team. Captain Molinet, who played last year, played a sensational game, shooting 11 field goals. The showing of the Varsity was better than was expected inasmuch as Captain Molinet and Sidman, who was put in as a substitute in the second half, were the only men who played last year. The Cornell lineup was as follows: Porter, r. f., Molinet, l. f., Rippe, c., Bastain, r. g., Cornish, l. g., Sidman, r. f., substitute.

Asscciation of Civil Engineers

On Dec. 8th the Cornell Association of Civil Engineers held their second meeting of the year. Col. William G. Atwood, '92, formerly in command of the 17th Engineers and now Technical Adviser for the Serbian Government, spoke on "The Experiences of the 17th U. S. A. Engineers in Europe." The meeting was open to the public and was very well attended. After the lecture a smoker was held in the Materials Laboratory. Dean Haskell and H. J. Benisch, '20, President of the Association, spoke briefly on the Honor System and the need of supporting the college in all forms of intercollege activities. Several stunts were given and Professor Urquhart presented shingles to the men who represented the college in the intercollege cross-country run.

Elections to Tau Beta Pi

Ten students of the Senior Class of the Colleges of Civil Engineering, Mechanical Engineering and the Department of Chemistry have been elected to Tau Beta Pi this term. The following men were selected from the College of Civil Engineering: Joseph Howard Christian, Carl Jay Hasbrouck, Alger Eugene Hunkin, and Herbert Harrington Linnell.

First Convocation Hour

Thomas W. Lamont of Harvard was the speaker at the first convocation hour this year. His subject was "Reconstruction in Europe." He pointed out how any description of Europe just now is bound to be more gloomy than the actual facts warrant. But the remedy has been recognized, and consists in work,—work individually and work collectively,—until conditions are restored to normal. He emphasized the fact that the Peace Treaty ought to be ratified without any more postponement, and that we should give up our selfish and distrustful attitude.

He concluded with an appeal for the support of the endowment fund campaigns that are now being carried on in practically all colleges and universities, for as he said, "There is one thing that these colleges of ours can do in the reconstruction of Europe, and that is to contribute trained minds to solve the problems that are pressing on us. But, unless we give them means of performance they cannot perform this service, and this duty."

Second Convocation Hour

J. W. O'Leary, '99, was the speaker at the second convocation hour this term, taking for his subject, "Industry," which he treated mainly from the standpoint of industrial unrest. Resolving the whole problem into a few words, Mr. O'Leary said, to him, there appeared only one solution: "We must dedicate ourselves to preparation against foreign invasion of wrong principles that threaten the future well-being of the country."

The speaker began his talk with a brief sketch of events leading up to the present labor crisis, and showed that due to industrial conditions, labor unrest had sprung up Then came the foreign influences and their bad effects.

Mr. O'Leary concluded with the words, "This is your nation and my nation, and we can tolerate only one kind of 'ism'—good, wholesome Americanism."

Kreisler Concert

Fritz Kreisler appeared at Bailey Hall on the evening of Dec. 11, 1919, in the second concert of the series held under the auspices of the Cornell University Department of Music. His well chosen program was charmingly played to an appreciative and enthusiastic audience, which filled Bailey Hall.

The Third Convocation Hour

The third convocation lecture was given by Mr. Raymond Robins. He spoke on industrial conditions from the view point of labor. Mr. Robins himself has been a laborer in a mine, working twelve hours a day, seven days a week. He therefore spoke from experience as well as from a careful study of economic and social conditions.

The radicalism which is coming from Russia, he said, was a challenge to the institutions and economic order of every nation. The United States, moreover, is, in his opinion, the only nation which can meet this challenge. The United States is able to do it because there is such faith in the free competitive economic system that if it were asked of the American working men which of the three systems he preferred, Marxian Socialism, Communism, or the Free Competitive System, the answer would be almost unanimously given, "Free Competition."

The prosperity and wealth of the United States have been due to this free competition, and although it has its defects and wastes, yet it is the best system for it succeeds in *producing*, which is the aim and purpose of all economic systems.

ALUMNI NOTES

'94. Benjamin F. Latting is engaged in the design of a dirigible air ship hangar for Brooks Field, Texas. His address is 140 You Street, N. E., Washington, D. C.

'98. A. H. Horton is Chief of the Division of Power Resources, Department of the Interior, Washington, D. C. Mr. Horton mentions in his letter the lack of training received by technical students in courses such as Public Speaking and preparation of articles for publication. We are glad to be able to inform our Alumni that the Cornell College of Civil Engineering has recognized this need, and all students are now required to take a course in Public Speaking and a course in Technical English.

'05. Harold F. Hamlin was discharged from the Military Service at Camp Humphrey on December 5th of last year with the rank of Captain of Engineers.

'09. A. Diamant has returned to Tocopilla, Chile, where he expects to remain for about three years.

'13. Frank Herrmann, who is residing in Santa Fe, N. M., is Bridge Engineer and Assistant to the Assistant State Highway Engineer, State Highway Commission, Santa Fe, N. M.

'13. A. A. Lacazette is engineer and lubricating specialist for the West India Oil Co., for its Cuba territory. His address is Calle 2, entre g. y. 11, Havana, Cuba.

'13. Henry Ten Hagen, who was discharged from the 3d Engineers at Corozal, Canal Zone, Panama on June 27th, 1919, is now County Assistant Engineer for the New York State Commission of Highways and in charge of Wyoming County. Before going to Panama he served nine months in France with the 2d Engineers. He is now residing at Warsaw, New York.

'13. C. T. Wanzer, formerly of Lugoff, S. C., is now located at Longtown, S. C., R. F. D., care of Wateree Power Company.

'14. J. T. Burton is now residing at 60 Pearl Ave., Oil City, Pa., and is employed as Engineer with the South Penn Oil Co. of Pittsburgh, Pa.

'14. John M. Phillips now lives at Lathrop Avenue, Boonton, N. J. He is acting as Resident Engineer for Clyde Potts on the duplication of the 72 inch water supply line to Jersey City.

'16. Wilson T. Ballard served as a First Lieutenant, U. S. A., with the 305 Engineers in France, leaving there May 23, 1919. His regiment was demobilized on June 17th, 1919, at Washington, D. C. He now lives at 1622 Mount Royal Avenue, Baltimore, Md.

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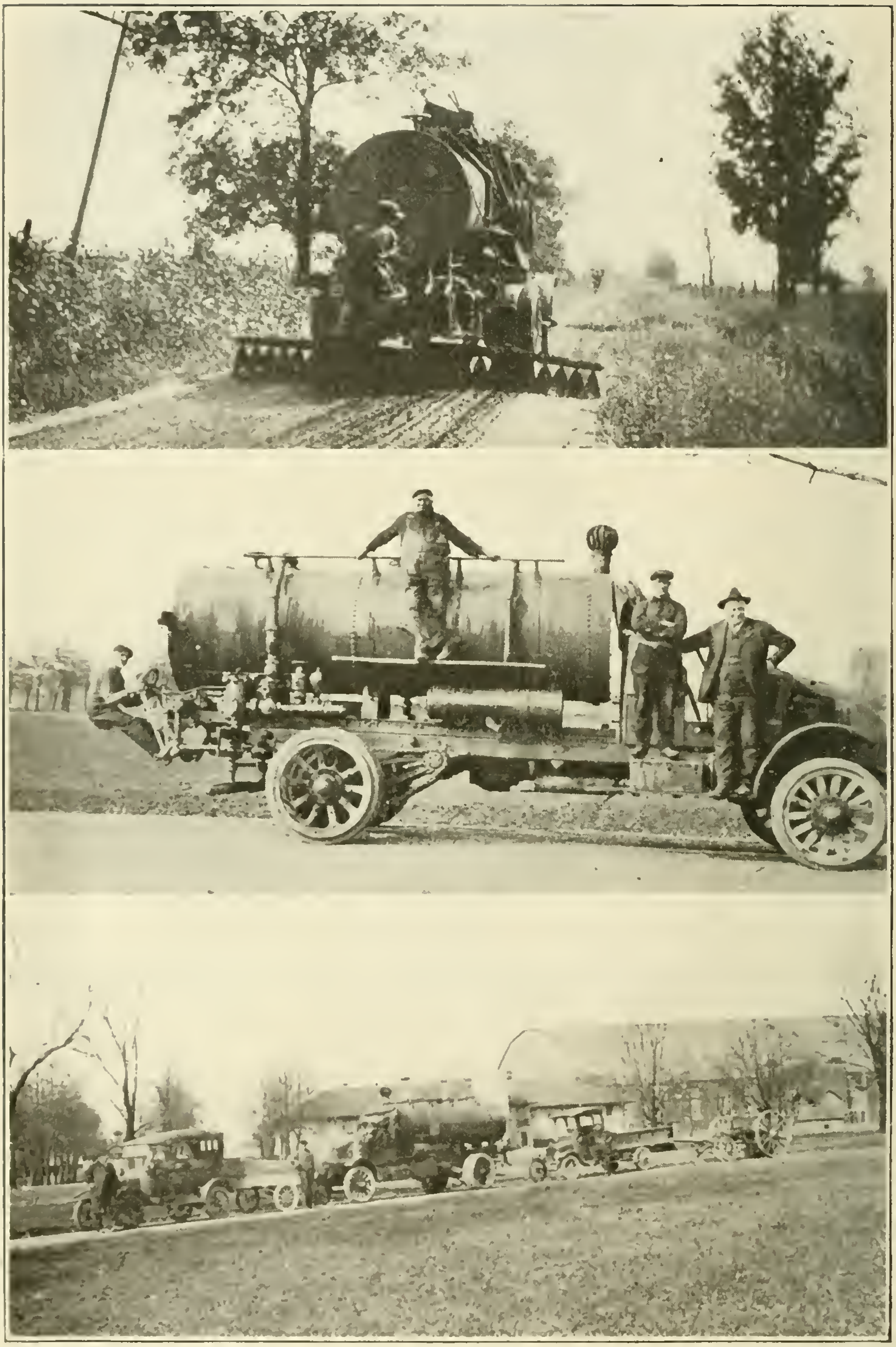

Distributor in Operation
Bituminous Distributor
Surface Treating Outfit Moving Between Jobs

SURFACE TREATMENT BY OHIO STATE HIGHWAY DEPARTMENT

THE CORNELL CIVIL ENGINEER
and
Transactions of the Association of Civil Engineers
of Cornell University

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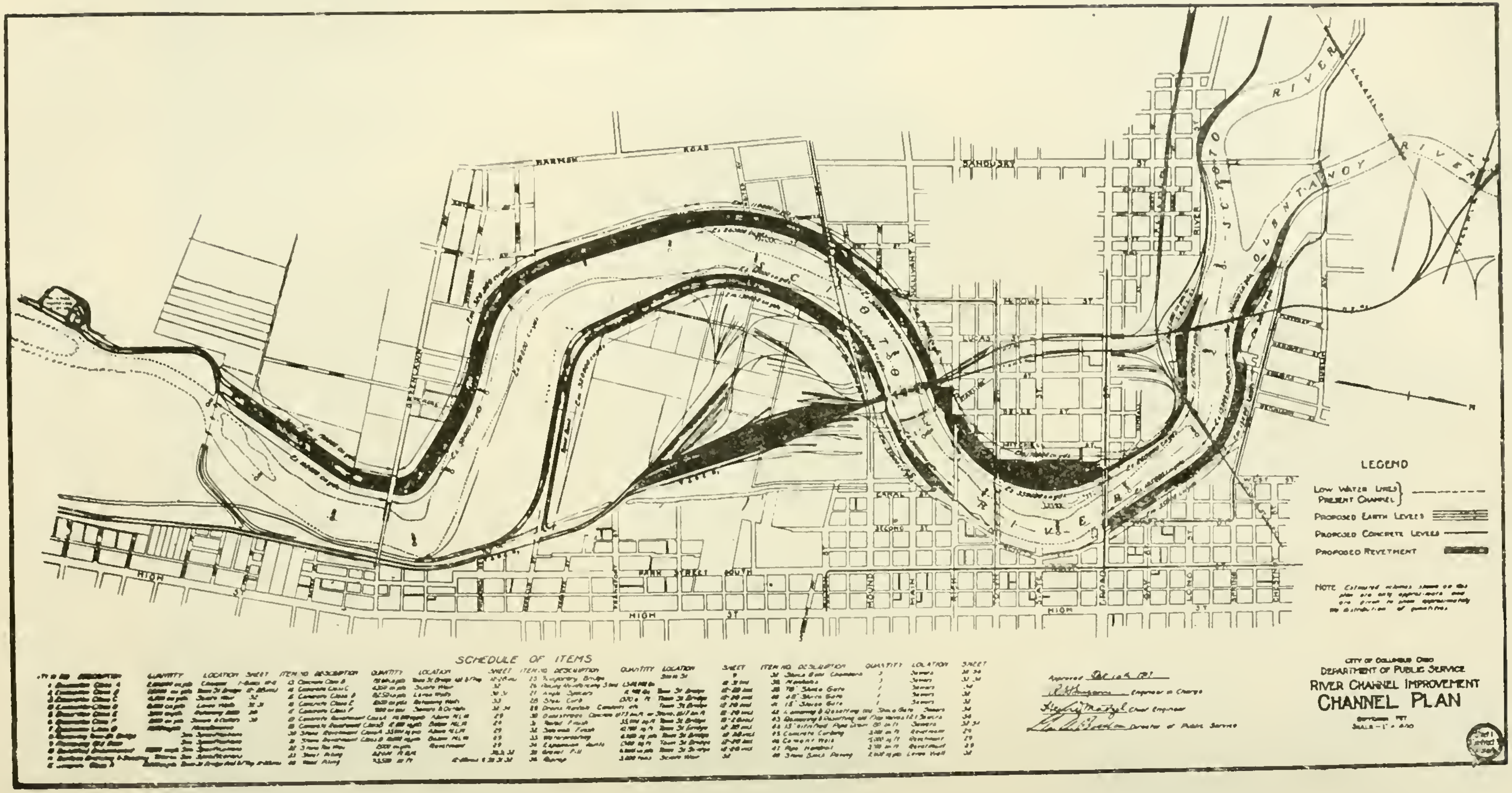
THE IMPROVEMENT OF THE SCIOTO RIVER CHANNEL AT COLUMBUS, OHIO, AS A MEANS OF FLOOD RELIEF

By R. H. Simpson, '96

Since the disastrous flood of March 1913, in which ninety-three lives were lost and a direct property loss of about ten million dollars was sustained, the flood problem in Columbus has been an active one. A cut-off channel planned to accommodate a flood flow in excess of the 1913 flood, involving an expenditure by the city of $8,500,000 failed to meet the approval of the voters, and later a comprehensive scheme of flooded protection for a considerable portion of the Scioto and Olentangy River valleys, estimated to cost about $10,500,000 was rejected by the Court on the ground that the benefits derived from the project would not justify the expenditure.

In the fall of 1916 the citizens residing in the flood zone, believing that complete protection was not economically feasible, started a movement calling for the expenditure of $3,500,000 for an improvement of the river channel through the city. This project was undertaken by the City of Columbus as a city enterprise, after being approved by two-thirds of the electors of the municipality, as is required under Ohio laws, and the writer was placed in charge of the improvement.

Under instructions from the legislative branch of the City Government, plans were to be prepared and submitted for approval showing the best means for flood protection by an improvement of the Scioto and Olentangy Rivers to the end that the greatest possible flood flow may be obtained for the sum of $3,500,000. In this article the writer will endeavor to outline briefly the conditions controlling the problem and describe the project.


LEGEND
Low Water Lines
Present Channel
Proposed Earth Levees
Proposed Concrete Levees
Proposed Revetment
NOTE
City of Columbus Ohio
Department of Public Service
River Channel Improvement
CHANNEL PLAN
Scale – 1" = 400
Approved
Engineer in Charge
Chief Engineer
Director of Public Service
SCHEDULE OF ITEMS
SCIOTO RIVER
OLENTANGY RIVER
SANDUSKY ST
HARMON ROAD
HIGH ST
PARK STREET SOUTH
LUCAS
MCDOWELL ST
CANAL
SECOND ST
RIVER

The city of Columbus, Ohio, is located at the confluence of the Scioto and Olentangy Rivers and is approximately in the geographical center of the State. The larger portion of the city, including the main business district, is on high ground to the east of the river valley. The low lands on the west and south of the Scioto River, that is, a considerable section of the river valley, are solidly built up largely with homes of moderate value, but with some considerable business properties and a few factories. It is this section, with a population of probably twenty thousand people, that is subject to floods.

The water shed of the Scioto Rover above Columbus comprises 1,050 sq. mi. and that of the Olentangy River 520 sq. mi. The average spring flood of the combined rivers is about 40,000 cu. ft. per second, or an average of about 34,000 cu. ft. per second for a twenty-four hour period. Occasionally however, the channel was taxed to its utmost capacity which was between 50,000 and 60,000 cu. ft. per second. The maximum flow during the flood of March, 1913, at the peak of the flood, was 140,000 cu. ft. per second; 80,000 on the Scioto River and 40,000 on the Olentangy River. The average for a twenty-four hour period at flood apex was about 119,000 cu. ft. per second. This average during this abnormal flood was three and one-half times the average spring flood and was caused by the greatest storm in the history of the country, approximately nine inches of rainfall being precipitated over both water sheds in four successive days.

The Scioto River flowing from the North emerges from a narrow rocky channel, just above the city, onto a level valley that is about two miles in width with bluffs on the east and west. The river flows eastwardly along the northern edge of this valley, or flood plain, to its confluence with the Olentangy River, which also flows from the north, and a short distance farther east the combined waters strike the eastern bluff, where the river sweeps to the south along the foot of same, passing within two squares of the principal business district of the city. After following the eastern bluff for about one-half mile, the river runs west-westwardly out into the flood plain, bending to the south at Mound street with low lands on either side. About three-fourths of a mile south of Mound street it bends eastwardly again and strikes the bluff near Greenlawn avenue. Below Greenlawn avenue, it bends slightly to the west and then south, following a fairly straight course about one-fourth of a mile distant from the easterly bluff for a distance of two and one-half miles, passing the city sewage and garbage works. Below Columbus the flood plain of the Scioto River has a width of over one mile for a distance down stream of about twelve miles.

Prior to the settlement of the valley, more than a century ago, a rise of the river to such an extent as to over-flow its banks caused the broad valley, or flood plain, to be covered with water, but as the land became inhabited by the white man and built up, he objected to having the water cover his land and fill his cellar every time the river would rise and he naturally began to construct embankments along the south and west sides of the Scioto River to protect him from flood waters. The levees along the river represent a gradual growth, stimulated partly by private enterprise and partly by the city, and as the ground became valuable these levees were naturally constructed as close to the channel as possible, thereby restricting it to such a width that was inadequate to pass the flood waters. The height of the levees has been governed largely by previous high water stages of the river, with some consideration, of course, to the margin of safety. They therefore represent the experience of the city and its citizens for a period of seventy-five years.

As a rule the levees were raised each time when the necessity was made evident by a record flow that reached the top of those previously thought to be adqeuate. After the flood of 1898, which over-topped the levees and caused considerable damage, an improvement which involved the raising of the levees six feet above the high water of that year was carried out with the idea of providing for a twenty-five per cent increase in flood flow, but the 1913 flood demonstrated that this result was not attained.

From topographical maps in our possession a number of tentative studies were outlined, and it soon became evident that for a given cross-section, it would be more economical to widen the present channel than to attempt to eliminate the curvature by cut-off channels. It was also considered desirable to disturb as little as possible the existing characteristics of the channel, or its conditions of dynamic equilibirum. A cut-off channel would increase the velocity and therefore the discharge through the new cut-off, but the conditions above and below would be changed to such an extent as to cause instability and no doubt some sort of regulation to control the flow would be required. Besides, uniformity of flow at all points is more to be desired than a rapid flow through the city, only to be followed by a slowing up below.

A study of the widening projects soon led to the conclusion that a channel with a minimum width of five hundred and eighty feet would pass the flood waters of March 1913, but such a project involved the removal of over two and one-half million cubic yards of material and would cost about $4,500,000. Another plan was therefore devised which, by using the same width of channel, but reducing the volume of excavation and eliminating some bridge work and other features not considered essential, could be carried out with the available funds. This project was adopted and has the merit of being capable of future increase of channel capacity, by the excavation of additional material from the river bed at any time funds may be available.

The project in general consists of widening and improving the present channel of the Scioto River, from the confluence of the Olentangy River to the municipal railroad bridge, near the city sewage pumping station, a distance of about four and one-half miles. Below this point flood waters will spread out over a wide valley. Through the congested district of the city, that is, from the confluence to a point south of Mound street, the channel will have a minimum width of 580 feet, measured from points half way down the levee slopes.

The excavation is made largely from the west side of the river, but at several points, in order to provide a better alignment, a considerable volume of material is removed from the east side. From a point below Mound street to Greenlawn avenue the present levee on the westerly side of the river will be widened and straightened, while on the easterly side a new levee will be constructed providing for a flood plain of about one thousand feet. The low water channel is not disturbed on this section and no excavation is made except to widen the throat at Greenlawn avenue. From Greenlawn avenue to the Municipal Railroad bridge, the old levee on the west side has been removed, the excavation being carried down to the low water level. This gives an additional width for flood waters.

The new levees are all laid out on curves connected by tangents. The radii of the curves range from twelve hundred to fifty-two hundred feet in length. With a few exceptions the levees will have a top width of eighty feet, to provide for future boulevard construction. The slopes will be three to one and will be grassed. On the outside of curve, however, the river slope will be paved with a four inch reinforced concrete slab as a protection against erosion.

The project requires the lengthening of five railroad bridges and the reconstruction or lengthening of eight highway bridges. Several of the latter will be concrete arch structures, three of this type now being in course of construction.

The purchase of the necessary right-of-way for the improvement involved an expenditure of approximately $1,000,000, as the widening cut into a closely built up territory. About two hundred and fifty parcels of land were purchased and some two hundred buildings, ranging in size from one-story cottages to four-story brick factories have been razed. One unusual feature in this connection was the use of a large number of heavy timbers from old buildings for a temporary bridge and other constructional uses with a material saving.

As it was not possible to excavate a channel of sufficient cross-sectional area to pass a flood flow equal to that of 1913 flood, a spill-way levee wall was introduced in the design which fixes a definite limit to the capacity of the channel. This wall was located a short distance below the confluence of the Olentangy River, on the west side of the river, and extends from the Broad street bridge to the Pennsylvania Railroad bridge, a distance of about twelve hundred feet. The top of the wall is two and one-half feet lower than the earthen levees immediately up stream from same and will give a relief over-flow up to 10,000 cu. ft. per second, which will reduce to a minimum the area covered by, and the amount of damage due to, the possible excess of flood flow over the capacity of the channel.

The probable capacity of the improved channel has been given considerable study. By platting cross-sections from the topographical maps and from definite known slopes determined from known heights of former flood flow a fairly definite conclusion as to the capacity has been reached. The only uncertain factor being the value of "n" in Kutter's Formula. This co-efficient of roughness has been determined from experiments in small channels and is estimated by various authorities to vary from .025 for rivers in good condition to .050 for streams with extremely rough beds. Very few if any experiments however have been made on channels of the size of that under consideration.

Some flow data was obtained on the flow water in the Scioto River shortly after the 1913 flood, the results showing a variation of some .030 to .040 for the value of "n". More recent and probably more careful calculations were made by the engineers of the Miami Conservancy District (See Calculation of Flow in Open Channels, Ivan E. Houk) on the flow of water in large streams, measurements being taken on the Miami River at Tadmor, Dayton, and Hamilton, Ohio, and on the Ohio River at Cincinnati. These investigations show that for straight regular stretches large streams with sand and gravel beds the value of "n" is about .025.

What effect the curvature of the channel under consideration would have on the value of "n" is not definitely known, but from calculations made on the Mississippi River above New Orleans, a stretch of river having considerable curvature, (See report referred to above) the value of "n" ranges from .0308 to .035. I feel therefore that for the improved channel of the Scioto River the value of .035 for "n" is conservative and using this figure with the known slope we obtain a discharge at the ultimate capacity of the channel of about 125,000 cu. ft. per second.

The maximum velocity at highest flood stage will be about eight feet per second, and through the bridge openings probably ten feet per second. These velocities are slightly in excess of what might be desired, and we can reasonably expect that some damage to the channel may occur after a capacity flood. I do not, however, consider this a serious objection, as the capacity flood can not be expected to occur, except at rare intervals.

The project has been under course of construction since April, 1918 and is approximately fifty per cent completed. It is being done under the direction of the Director of Public Service of the City of Columbus, Henry Maetzel being chief engineer of the department and the writer in direct charge of the project.

INSPECTIONS AND TESTS OF RUN-OFF RECORDS

By C. H. Pierce.*

Records of stream flow may in general be divided into two classes depending upon fundamental differences in the methods used in collecting the data. These two classes are:

A.—Open channel gaging stations.—Where the stream flows over its natural bed and the discharge is ascertained from observations of stage by the use of a discharge rating curve, this rating curve being determined by means of measurements of velocity and area. This is sometimes called the "velocity-area" method. (See U. S. Geological Survey Water-Supply Paper 318, page 19.) In this class are included those stations provided with "artificial controls," but where the discharge is determined from measurements of velocity and area; also venturi meters and other special recording devices which have been rated in position by means of the velocity-area method.

B.—Stations at dams and power plants.—Where the measurement of discharge depends upon determination of flow over the dam and through the wheels, canals, spillways, or sluices. Weir stations, where the discharge is ascertained by means of formulas not verified individually by direct measurements, are included in this class.

It is not the intent of this paper to compare the advantages or disadvantages of these two methods of collecting stream flow data. Each has its merits and also its difficulties, and either one might be preferable depending upon the local conditions. There are, however, certain requirements which are essential to the accurate determination of. discharge, and an examination of the methods used, both in collecting the base data and in making the computations, should show whether or not these essential requirements have been complied with.

The fundamental factors to be considered in determining the accuracy of stream flow data are the following:

A.—Open channel gaging stations.

1. Permanency of stage-discharge relation.
    a. Is the discharge rating curve, when once determined, applicable under all conditions and for all seasons of the year?
    b. If conditions require different rating curves at various times, are these conditions known and fully complied with?

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*District Engineer, Water Resources Branch, U. S. Geological Survey.

   c. Has a sufficient number of discharge measurements been made at all seasons of the year to verify the rating curve which was used, or to determine any corrections which may be necessary?
   d. Is the stage-discharge relation ever affected by logs, or by aqueous vegetation in the summer, or by ice in the winter? If so, what methods were used during these periods?

2. Measurements of discharge.
   a. Describe the measuring section with respect to smoothness of cross section and distribution of velocity.
   b. What equipment is used in measuring velocity?
   c. How is cross-section area determined?
   d. How many sections are used, i.e., how is the cross-section divided with respect to determination of velocity?
   e. How is mean velocity in each vertical determined?
   f. Are measurements of depth, taken at each observation point in a discharge measurement, checked against standard cross-section? (This applied more particularly to measurements made at high stages where it is difficult to obtain accurate soundings).
   g. What method is used in computing the total discharge and in ascertaining the correct mean gage height for the measurement? (See "Comparison Formulas for Computation od Stream Discharge," by J. C. Stevens, Eng. News, June 25, 1908, Vol. 59, page 682.)
   h. Are notes of current meter measurements computed before leaving vicinity of gaging station and computation subsequently checked by another person?
   i. How was measuring equipment standardized? If current meter is used, where and how often was its rating determined?
   j. What methods were employed to eliminate possible errors in instrumental equipment or personal equation of observer?

3. Records of stage.
   a. What type of gage is used?
   b. To what degree of refinement are gage readings taken, and with what frequency?

    - c. How is mean daily gage height ascertained?
    - d. Is gage datum referred to permanent bench marks?
    - e. How often is the gage tested with level?
    - f. If water-stage recorder is used, how is it referenced to gage datum?
    - g. Is gage height record referred to same gage and datum to which discharge measurements are referred?
    - h. Are gage records examined to detect possible need for correction before application of rating table?
    - i. How often is water-stage recorder inspected by local observer, and how are his reports made?
    - j. How often does an engineer visit the station and what form of report does he make?
    - k. What tests have been made to ascertain reliability of observer?

  - 4. Methods of computation.
    - a. Within what limits is rating curve defined by discharge measurements?
    - b. What method was used in extending rating curve above the well defined limit?
    - c. Is the rating curve so drawn that plus and minus per cent differences shown by individual measurements compensate, and how large are those differences?
    - d. Are the three curves of discharge, area, and velocity shown to be consistent?
    - e. What method is used in translating records of stage into rate of discharge in cubic feet per second?
    - f. What corrections, if any, are applied to recorder sheets, and how are the corrections determined?
    - g. Are office computations checked by a person other than the one making the original conputations?
    - h. Are the base data and computations finally reviewed by an experienced engineer who had no part in collecting the data or in making the conputations?

- B.—Stations at dams and power plants.
  - 1. Permanency of stage-discharge relation.
    - a. Are the several rating curves for spillway or weir crest, gates, and water wheels applicable under all conditions and for all seasons of the year?

- b. If conditions require different rating curves at various times, are those conditions known and fully complied with?
- c. Are flashboards used at times? If so, how is discharge computed when boards are not at standard or uniform height?
- d. How is leakage determined? (This should cover all losses not determined by direct measurement).
- e. Give description of all places of measurement and tell methods used.
- f. Does ice in canal or on spillway affect stage-discharge relation? (See Plate V-A, U. S. Geol. Survey Water-Supply Paper 244, for winter conditions at dam on Saranac River.)
- g. Have conditions of wheels, sluice gates, etc., remained constant since discharge rating was determined, and have direct measurements been made to verify the ratings?

2. Measurement of discharge.
   - a. How were discharge ratings determined? (Give full infornation for each place of measurement.)
   - b. Are the different heads on wheels, sluice gates, and spillway always within the range for which the ratings were determined?
   - c. In case computations of discharge are obtained from records of power output, how was the plant efficiency ascertained?
   - d. Have any of the ratings or coefficients been verified by direct measurements under actual operating conditions?
   - e. If direct measurements have been made, what methods were used? (See A-2).
3. Records of stage.
   - a. How often are readings obtained at each place of measurement?
   - b. etc. (see questions under A-3).
4. Methods of computation.
   - a. How is mean discharge determined?
   - b. Does same degree of accuracy hold for records during hours when plant is not in operation as for hours of operation?

c. Are office computations checked by a person other than the one making the original computations?

d. Are the base data and computations finally reviewed by an experienced engineer who had no part in making the original computations?

GENERAL COMPARISONS

One of the quickest and easiest tests of stream flow records is to plot the data in the form of a continuous hydrograph and compare with other records in the same drainage basin. A general comparison of a number of stations can easily be made by plotting monthly run-off in second-feet per square mile, or depth in inches on drainage basin. These comparisons should, however, be interpreted with the aid of common sense, and some knowledge of river hydrology, otherwise it may be possible to draw erroneous conclusions and reliable data may be condemned for the sake of adhering to preconceived ideas respecting the distribution of run-off.

At two gaging stations where the total yearly run-off is practically the same, the distribution by months may be widely different. If one station is considerably farther north than the other it may have a later spring break-up and the peak stage occur at a later date. For the winter months the farther north station will probably show a decidedly lower run-off, whereas the spring run-off is likely to be higher. These are the hydrologic characteristics for streams flowing toward the south. For rivers flowing from south to north, like some of those in the St. Lawrence river basin, some of the characteristics would be reversed when referred to direction of the compass, although remaining the same when referred to direction of stream flow. It is a generally recognized fact that the intensity of run-off increases in an inverse ratio to the size of the drainage basin. This may have its exception due to an abnormally low rainfall over a part of the basin. Whether the run-off be large or small there is for New England rivers a fairly well defined proportion which may be expected to pass down the river during certain seasons of the year, these seasons being arranged according to hydrologic conditions rather than calendar months. Frederic P. Stearns, in discussion of the November, 1918, Progress Report of the Boston Society of Civil Engineers Run-Off Committee, says:

"In my practice I have found it desirable in many cases to make a comparison between the run-off for the months from December to April, inclusive, and the precipitation for the same period. This period is long enough, except in some very cold places, to cover the whole period when the precipitation is temporarily stored on the surface of the ground in the form of snow and ice, and it covers substantially the season of minimum evaporation." * * * *

"During the five months from December to April, inclusive, there is always a large percentage of run-off, because the evaporation is small in the cold weather. On the other hand, in the months of July, August, and September there is a very small percentage of run-off because of the high evaporation. Showers wet the ground to a depth of only a few inches, but this water soon evaporates."

(This statement is, however, yet to be proven true for all cases.)

Other hydraulic engineers divide the year differently and have various proportions of the total run-off assigned to the different hydrologic seasons.

Special reference should be made to the method used by D. M. Wood in his "Comparison of New England Run-off Data," published in Stone & Webster Public Service Journal for February, 1917; also to Chapter VI, "Hydrology as Related to Stream Flow," in Hoyt and Grover's "River Discharge."

In the final analysis, it must be recognized that the seasonal distribution of run-off, and the effect of snow, ground, surface, and artificial storage, introduce so many complications that exact comparisons of run-off can not be made. and that the discharge of each stream obeys a law peculiar to itself.

BITUMINOUS SURFACE TREATING WORK

ORGANIZATION AND FORMS USED BY OHIO STATE HIGHWAY DEPARTMENT

D. O. Stone, '09
Maintenance Engineer

In 1911 a system of state routes was laid out in Ohio, consisting of the main roads and connecting the principle centers of population. Since that date the construction funds of the Ohio State Highway Department have been used only to improve sections of road lying upon and forming a part of these state routes. The total mileage of the state system is 9862 miles, of which at the present time, about 3000 miles have been improved by the state or accepted by the state for maintenance.

In 1911 a Maintenance and Repair Bureau was organized to take care of the roads thus built or accepted from the various counties. Due to the limestone deposits over a large part of the state, Ohio has built a large number of macadam roads, both of the waterbound and bituminous bound types. The policy of the department has been to maintain the macadam roads by means of bituminous surface treatment and, as the mileage of state roads increases, the importance of this class of maintenance work will also increase.

The department owns and operates four complete surface treating outfits which apply about 1,000,000 gallons of material each season. About an equal amount of material is also applied each season by contract.

ORGANIZATION

The surface treating gangs operate under the direct supervision of a Maintenance Engineer or his assistant engineer, located at the main office in Columbus, who lay out the work, arrange schedules for the outfits to follow, order materials, approve all payrolls and bills and visit the work as often as circumstances will allow.

The gang is in charge of a Superintendent who travels with the outfit, directs their operations, makes out the payrolls, secures and approves bills, employs labor and is held responsible for the condition of all equipment and the quality of the work done.

A foreman is carried to assist the superintendent and supervise the cleaning of the surface and the application of the covering material.

The distributor is manned by two experienced men, one of whom is a truck driver and usually the chief mechanic of the gang, who assists in loading the distributor and drives it. The other man is the operator who rides on the rear of the distributor, runs the heating attachment, watches the pressure and regulates the flow of the bituminous material onto the road surface.

A second truck driver is usually employed to operate the small general utility truck which forms a part of each outfit. From eight to twenty laborers are necessary, depending on the length of haul, to assist in cleaning the road surface and spread the covering material. As the Highway Department has one or more permanent repair gangs located in each county to take care of the ordinary maintenance work, the necessary laborers for surface treating work are usually secured from these gangs.

When the distributor superintendent finds a laborer who appears to be an exceptionally good man and who is willing to travel with the outfit, he is carried along and acts as a laborer until there is an opening for him to be appointed to one of the better paying positions.

During the winter months about two men from each outfit are retained to take down and thoroughly repair and overhaul each piece of equipment. The department arranges with the leading automobile truck manufacturers of the state to employ some of the drivers and operators during the winter months, so when they return to the road work in the spring they are more experienced with trucks and machinery and thus make very valuable men.

All but one of the distributor superintendents now employed by the department have worked up from subordinate positions with the outfits, so are familiar with every detail of the work. In this manner an organization of experienced men has been built up, which economically and efficiently carries on this class of work.

EQUIPMENT

All of the surface treating outfits have been motorized as far as possible to expedite the work and to reduce to a minimum the time lost by moving between jobs. Each distributor superintendent is supplied with a Ford touring car so that he can easily keep in touch with all parts of the work from the railroad station to the road being treated and go ahead to make advance arrangements for his next job.

The superintendent is the only man whose board and room expenses are paid by the department. A compact, two wheeled, folding camp trailer forms a part of each outfit and furnishes very comfortable sleeping quarters for the truck drivers, foremen, operator and any laborers who are traveling with them. While moving between jobs this trailer is attached to the superintendent's touring car. A separate cook tent and stove are also supplied which make a very complete camping equipment for the men.

As all work done by these outfits is outside of municipalities and is limited to the summer months, these camping outfits have been popular with the men and it has been less expensive for the State than paying their board and room.

The bituminous distributors are mounted on 5½ and 6 ton special automobile truck chassis and consist of a 1000 gallon tank with flues connected with a gasoline or kerosine heater and a pump, driven from the truck motor to load and discharge the distributor tank.

A heavy mechanical street sweeping broom equipped with wire filled spindles is used to clean the road surface before the bitumen is applied. This can be pulled behind a truck or drawn by a team of horses.

A one and one-half or two ton truck equipped with an express body forms a part of each outfit and is very useful for carrying laborers, keeping the distributor supplied with fuel, drawing the sweeper shifting covering material where an uneven distribution has been made, etc. For long moves between jobs the sweeping broom is dismantled and carried on the bed of the small truck.

A complete set of small tools is carried with each outfit to enable them to make repairs to their equipment as well as shovels, hand brooms, warning signs, etc., to completely carry on the work without outside assistance.

FORMS

All information needed by the Superintendent to locate the road he is to work upon, the material he is to use and rate at which he is to apply the material is contained on the "Superintendent's Information Sheet", a separate sheet being sent him for each different job.

Payrolls are submitted bi-monthly or immediately upon the completion of the work in a given county, on the standard department payroll blanks. Individual warrants are drawn for each man employed and sent to the superintendent for distribution.

Bills for material, supplies, demurrage, etc., are approved by the superintendent and warrants mailed directly from the main office to the parties furnishing the material or service.

At the close of each working day the distributor superintendent submits a "daily report" showing in detail the operations for the day as well as the number of men employed on the various phases of the work and causes for delays, if any.

A "weekly report of motor vehicles" is received from the driver of every truck and automobile forming a part of the outfit which shows in detail the cost of operation, the miles run each day as well as an explanation of where the machine was used or driven.

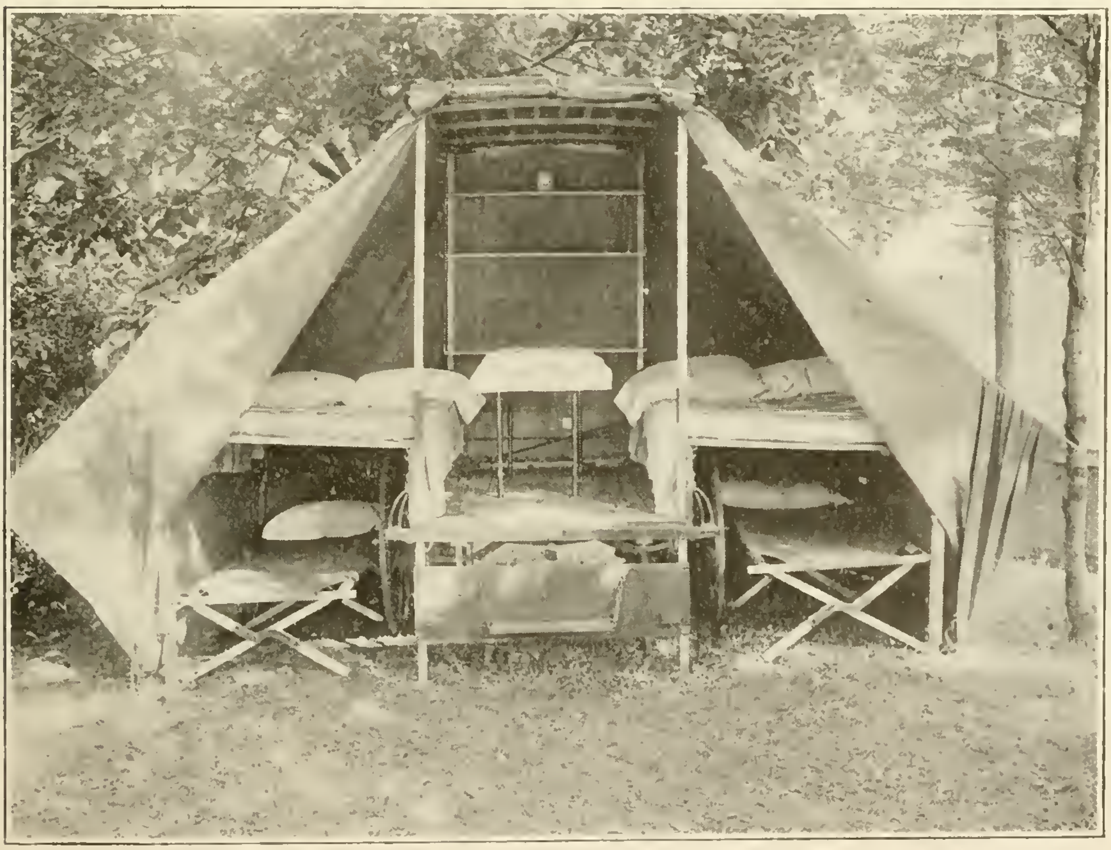
The office records of the work done by the surface treating outfits are of two kinds:

(1) Financial, which are taken care of by the bookkeeping department and

(2) A record of actual operations and progress, kept by the engineer in charge of the work.

Each job has a separate pocket in a filing cabinet which contains a "record of surface treatment" card which gives complete information concerning the road to be treated and the treatments to be given. The card is designed to be used for all surface treating jobs, whether they are done by contract or by force account, and will show at a glance just what steps have been taken regarding the work, whether the engineer in charge happens to be in the office or on an inspection trip. In the same pocket with the record card is filed a copy of the superintendent's daily reports as they come in and any correspondence concerning the job.

The organizations and forms described in this article are the result of several years experience and are giving satisfactory results. The cost to the State of Ohio of doing this class of work by force-account runs from 15 to twenty per cent less than the same work done by contract, and the quality of the work is on the whole superior to contract work.



FORMS USED BY OHIO STATE HIGHWAY DEPARTMENT

MILEAGE RECORD OF TIRES

THIS RECORD TO BE FILLED IN ONLY WHEN TIRES ARE CHANGED

POSITION ON MACHINE		TIRE		SPEEDOMETER READING		Total Miles	REMARKS
		Name and Number	Size	Put on	Taken off	Tire Run	Condition and Disposal of Tire When Taken Off
Front Wheel	Left						
	Right						
Rear Wheel	Left						
	Right						

Remarks concerning general condition of Machine and Repairs that will be needed in the near future.

THE CONDITION OF YOUR MACHINE IS AN INDICATION TO DEPARTMENT OF YOUR ABILITY AS A DRIVER

Before starting work each day be sure that—

(1) There is the proper amount of oil in the crank case.
(2) The radiator is filled with water.
(3) All pneumatic tires are properly inflated with air.
(4) There is enough gasoline for the day's run.

Have a regular time for thoroughly oiling bearings and filling grease cups, and never let anythin nterfere with this being done.

No. 1

Form M & R.—3035—19-400 Pads

OHIO STATE HIGHWAY DEPARTMENT
BUREAU OF MAINTENANCE AND REPAIR

ORIGINAL

Weekly Report of Motor Vehicles

COUNTY

MAKE AND TYPE OF TRUCK OR AUTOMOBILE

DEPT. No.

			MONTH																				Total Cost for Week	REMARKS
		Day of Month																						
		SUN			MON			TUES			WED.			THURS.			FRI			SAT				
		Gal.	@	Cost	Gal.	@	Cost	Gal.	@	Cost	Gal.	@	Cost	Gal.	@	Cost	Gal.	@	Cost	Gal.	@	Cost		
EXPENSE	Gasoline																							
	Oil	Qts.			Qts.			Qts.			Qts.			Qts.			Qts.			Qts.				
	Grease	Lbs.			Lbs.			Lbs.			Lbs.			Lbs.			Lbs.			Lbs.				
	Tires																							
	Repairs																							
	TOTALS																							
MILEAGE	Speedometer Reading Evening																						Total Miles During Week	
	Speedometer Reading Morning																							
	Miles Run																							
LOCATION	Where Machine was driven or used	I. C. H			I. C. H			I. C. H			I. C. H.			I. C. H.			I. C. H.			I. C. H.				
		Sec.			Sec.			Sec.			Sec.			Sec.			Sec.			Sec.				

REPORT No.

FOR SEASON OF 19

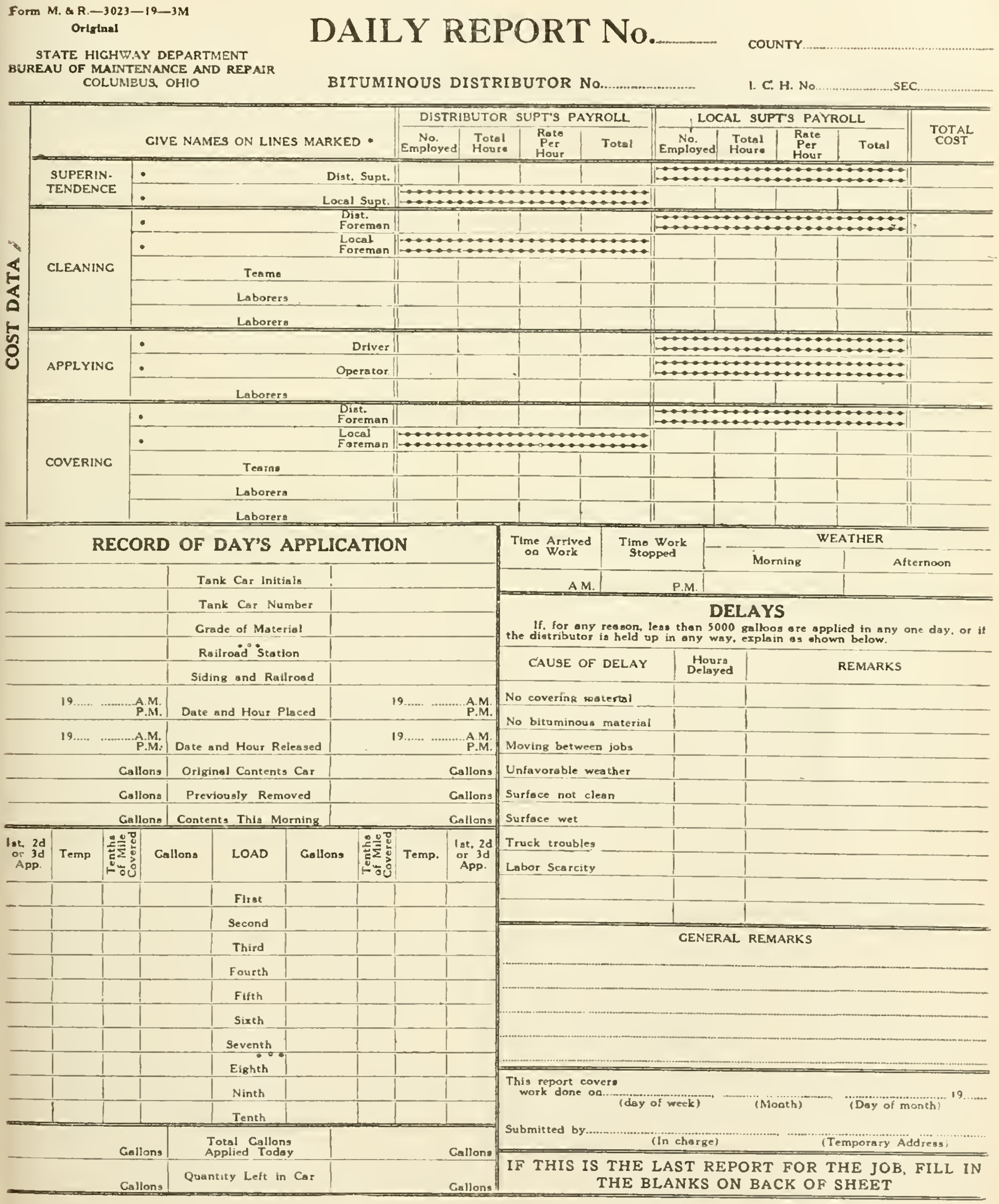
SUBMITTED BY Driver 19

ADDRESS Postoffice Street or R. F. D OHIO

(over)

No. 2

(Reverse side of No. 1)



Form M. & R.—3023—19—3M
Original

STATE HIGHWAY DEPARTMENT
BUREAU OF MAINTENANCE AND REPAIR
COLUMBUS, OHIO

DAILY REPORT No.........

COUNTY..........

BITUMINOUS DISTRIBUTOR No..........

I. C. H. No..........SEC..........

COST DATA

	GIVE NAMES ON LINES MARKED •	DISTRIBUTOR SUPT'S PAYROLL				LOCAL SUPT'S PAYROLL				TOTAL COST
		No. Employed	Total Hours	Rate Per Hour	Total	No. Employed	Total Hours	Rate Per Hour	Total	
SUPERINTENDENCE	• Dist. Supt.									
	• Local Supt.									
CLEANING	• Dist. Foreman									
	• Local Foreman									
	Teams									
	Laborers									
	Laborers									
APPLYING	• Driver									
	• Operator									
	Laborers									
COVERING	• Dist. Foreman									
	• Local Foreman									
	Teams									
	Laborers									
	Laborers									

RECORD OF DAY'S APPLICATION

	Tank Car Initials	
	Tank Car Number	
	Grade of Material	
	Railroad Station	
	Siding and Railroad	
19...... ..........A.M. P.M.	Date and Hour Placed	19...... ..........A.M. P.M.
19...... ..........A.M. P.M.	Date and Hour Released	19...... ..........A.M. P.M.
Gallons	Original Contents Car	Gallons
Gallons	Previously Removed	Gallons
Gallons	Contents This Morning	Gallons

1st, 2d or 3d App.	Temp	Tenths of Mile Covered	Gallons	LOAD	Gallons	Tenths of Mile Covered	Temp.	1st, 2d or 3d App.
				First				
				Second				
				Third				
				Fourth				
				Fifth				
				Sixth				
				Seventh				
				Eighth				
				Ninth				
				Tenth				

Gallons	Total Gallons Applied Today	Gallons
Gallons	Quantity Left in Car	Gallons

Time Arrived on Work	Time Work Stopped	WEATHER	
		Morning	Afternoon
A.M.	P.M.		

DELAYS

If, for any reason, less than 5000 gallons are applied in any one day, or if the distributor is held up in any way, explain as shown below.

CAUSE OF DELAY	Hours Delayed	REMARKS
No covering material		
No bituminous material		
Moving between jobs		
Unfavorable weather		
Surface not clean		
Surface wet		
Truck troubles		
Labor Scarcity		

GENERAL REMARKS

....

....

....

....

This report covers work done on.........., ..., ...19......
(day of week) (Month) (Day of month)

Submitted by.........., ...
(In charge) (Temporary Address)

IF THIS IS THE LAST REPORT FOR THE JOB, FILL IN THE BLANKS ON BACK OF SHEET

No. 3

THIS INFORMATION MUST BE GIVEN ON THE LAST REPORT FOR EACH JOB

	Car Initials	Car Numbers	Days on Demurrage	Amount of Bill	Have you Obtained Demurrage Bill?
TANK CAR DEMURRAGE					

HEATING

If heat was used on the Tank Cars, explain fully the arrangements made..................

MOVING BROOM

Explain upon what date and how the broom was moved to next job..............................

COVERING MATERIAL

Was the covering material uniformly spaced along the whole section and piles well made and conveniently spaced?........................If not explain..

....

Was more covering material delivered than was necessary for the work?......................

If so about how much is left over?...

Was there a shortage of covering material to give the best results?..............................

If so about how much more should have been ordered?...

Should more be ordered to protect the surface?...

Have you made any arrangements to get this material?..

If so explain arrangements made ....

....

No. 4

(Reverse side of No. 3)

Form M. & R.—3040—19—1M STATE HIGHWAY DEPARTMENT
BUREAU OF M. & R.

SUPERINTENDENT'S INFORMATION SHEET

For Bituminous Surface Treatment

DISTRIBUTOR No..........................

County ....

To Mr...

I. C. H. No................Sec..............

....

....

Columbus, Ohio,................19........

The information given below is for your guidance in applying a bituminous surface treatment to the section of road described as follows:—

....

....

....

Type and condition of surface ....

Instructions concerning cleaning..

	Length in Miles	Width in Feet	Number of Gallons	Kind of Material	Gallons per Sq. Yd.	APPLICATION		REMARKS
						No. of	Temperature	

Delivery Point.................................... Railroad.................................... Siding.................................... Average Haul....................miles

Shipped by.................................... From.................................... To be delivered....................19.......

In cases where cars for the same section are shipped to more than one station, or in cases where the same car is used on more than one section, the following additional information is given:—

CARS TO BE DELIVERED			Kind of Material	Gallons in Car	TO BE DISTRIBUTED					REMARKS
Station	Railroad	Date			Gallons	Kind	County	I. C. H.	Sec.	

SPECIAL INSTRUCTIONS

Heating material in car..

For securing labor, etc., consult:..

Remarks: ....

....

....

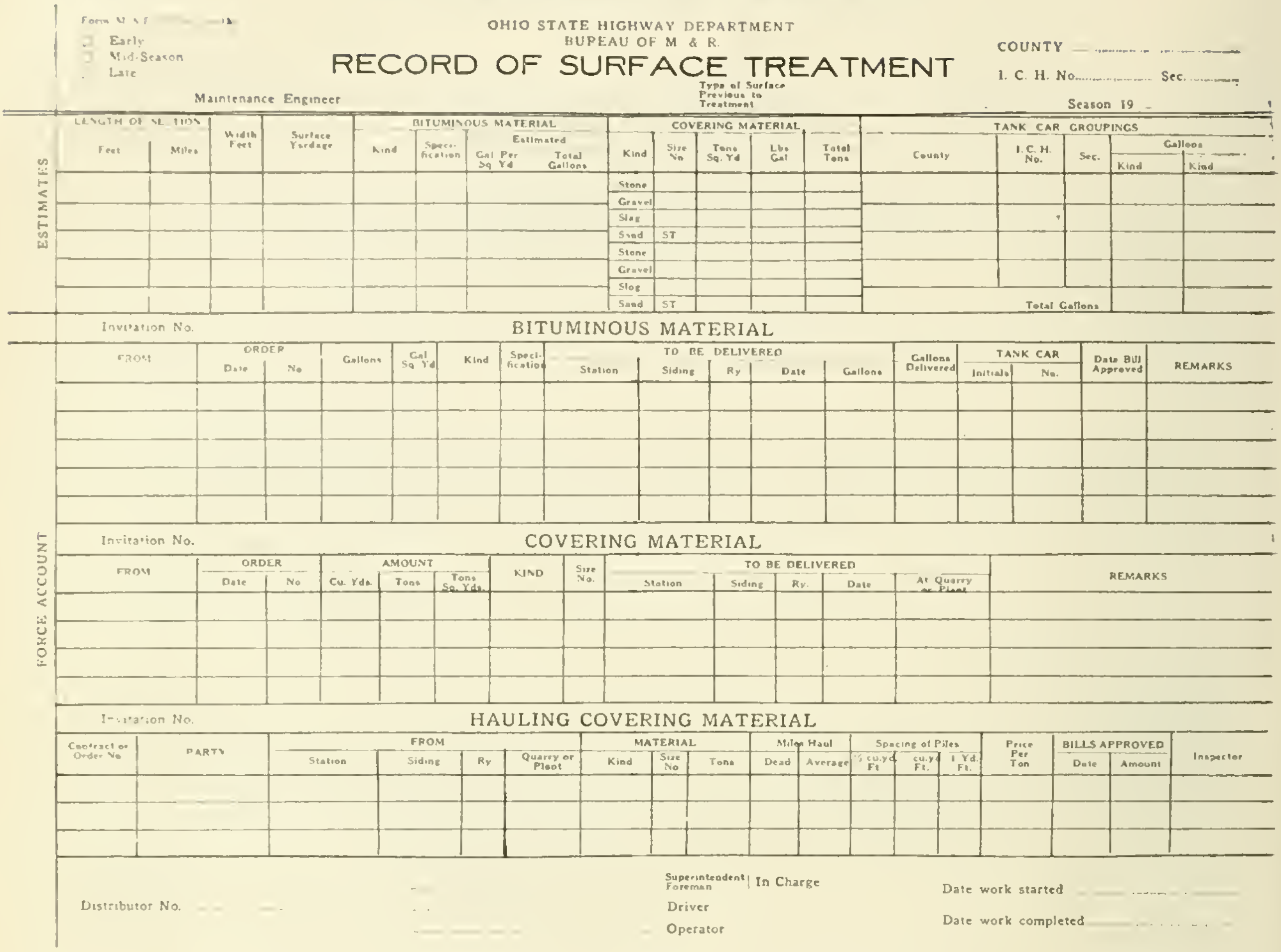
In moving to your next job the following route is suggested: ....

....

Your next job is: Submitted by..

..............................Co.—I. C. H. No............ Sec............ Title ....

No. 5



Form M. S. T.

☐ Early
☐ Mid-Season
☐ Late

OHIO STATE HIGHWAY DEPARTMENT
BUREAU OF M & R.

RECORD OF SURFACE TREATMENT

COUNTY
I. C. H. No. Sec.

Maintenance Engineer

Type of Surface Previous to Treatment

Season 19

ESTIMATES

LENGTH OF SECTION		Width Feet	Surface Yardage	BITUMINOUS MATERIAL				COVERING MATERIAL					TANK CAR GROUPINGS				
Feet	Miles			Kind	Specification	Estimated		Kind	Size No	Tons Sq. Yd	Lbs Gal	Total Tons	County	I. C. H. No.	Sec.	Gallons	
						Gal Per Sq Yd	Total Gallons									Kind	Kind
								Stone									
								Gravel									
								Slag									
								Sand	ST								
								Stone									
								Gravel									
								Slog									
								Sand	ST						Total Gallons		

FORCE ACCOUNT

Invitation No.

BITUMINOUS MATERIAL

FROM	ORDER		Gallons	Gal Sq Yd	Kind	Specification	TO BE DELIVERED					Gallons Delivered	TANK CAR		Date Bill Approved	REMARKS
	Date	No					Station	Siding	Ry	Date	Gallons		Initials	No.		

Invitation No.

COVERING MATERIAL

FROM	ORDER		AMOUNT			KIND	Size No.	TO BE DELIVERED					REMARKS
	Date	No	Cu. Yds.	Tons	Tons Sq. Yds.			Station	Siding	Ry.	Date	At Quarry or Plant	

Invitation No.

HAULING COVERING MATERIAL

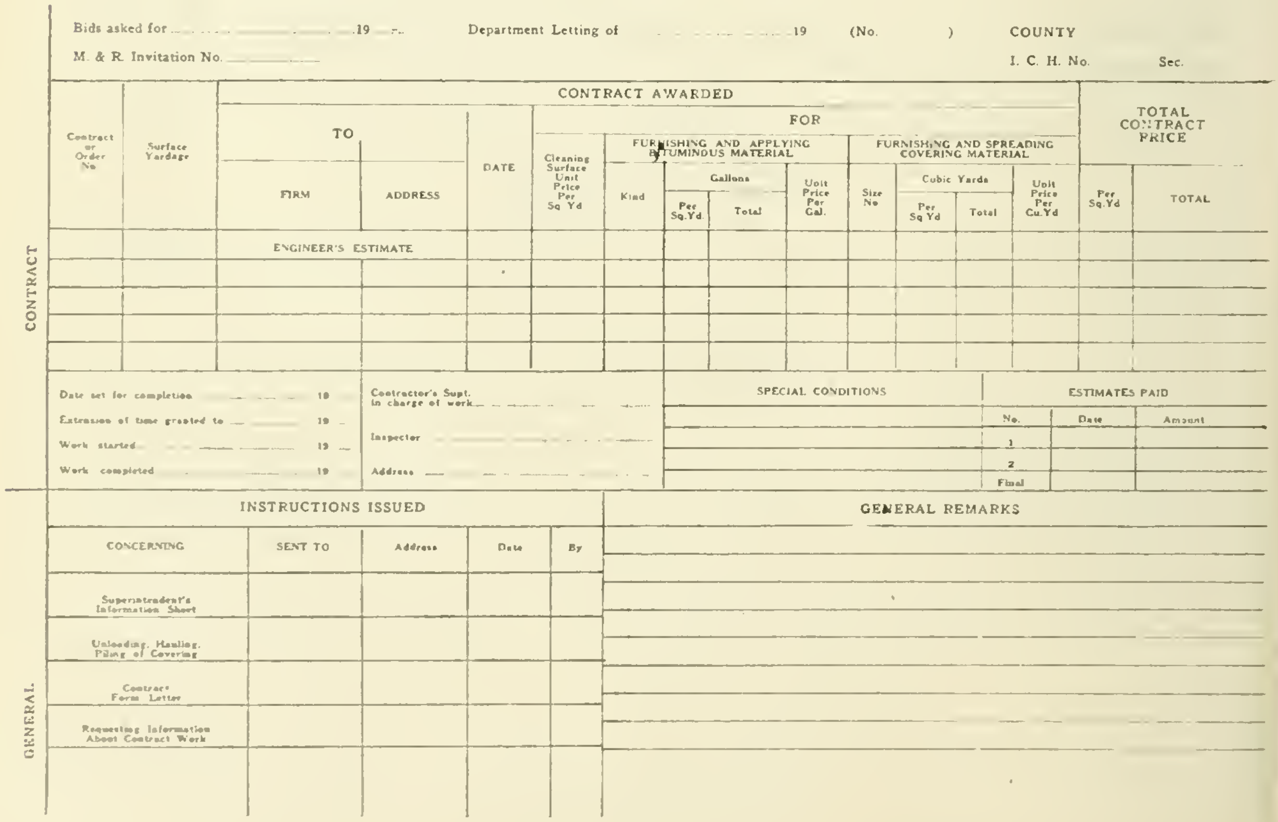
Contract or Order No	PARTY	FROM				MATERIAL			Miles Haul		Spacing of Piles			Price Per Ton	BILLS APPROVED		Inspector
		Station	Siding	Ry	Quarry or Plant	Kind	Size No	Tons	Dead	Average	½ cu.yd Ft	cu.yd Ft.	1 Yd. Ft.		Date	Amount	

Distributor No.

Superintendent / Foreman | In Charge
Driver
Operator

Date work started
Date work completed

No. 6



Bids asked for 19 Department Letting of 19 (No.) COUNTY
M. & R. Invitation No. I. C. H. No. Sec.

CONTRACT

Contract or Order No	Surface Yardage	CONTRACT AWARDED												TOTAL CONTRACT PRICE	
		TO		DATE	FOR										
					Cleaning Surface Unit Price Per Sq Yd	FURNISHING AND APPLYING BITUMINOUS MATERIAL				FURNISHING AND SPREADING COVERING MATERIAL					
						Kind	Gallons		Unit Price Per Gal.	Size No	Cubic Yards		Unit Price Per Cu.Yd		
		FIRM	ADDRESS				Per Sq.Yd.	Total			Per Sq Yd	Total		Per Sq.Yd	TOTAL
		ENGINEER'S ESTIMATE													

Date set for completion 19
Extension of time granted to 19
Work started 19
Work completed 19

Contractor's Supt. in charge of work
Inspector
Address

SPECIAL CONDITIONS

ESTIMATES PAID

No.	Date	Amount
1		
2		
Final		

GENERAL

INSTRUCTIONS ISSUED

CONCERNING	SENT TO	Address	Date	By
Superintendent's Information Sheet				
Unloading, Hauling, Piling of Covering				
Contract Form Letter				
Requesting Information About Contract Work				

GENERAL REMARKS

No. 7

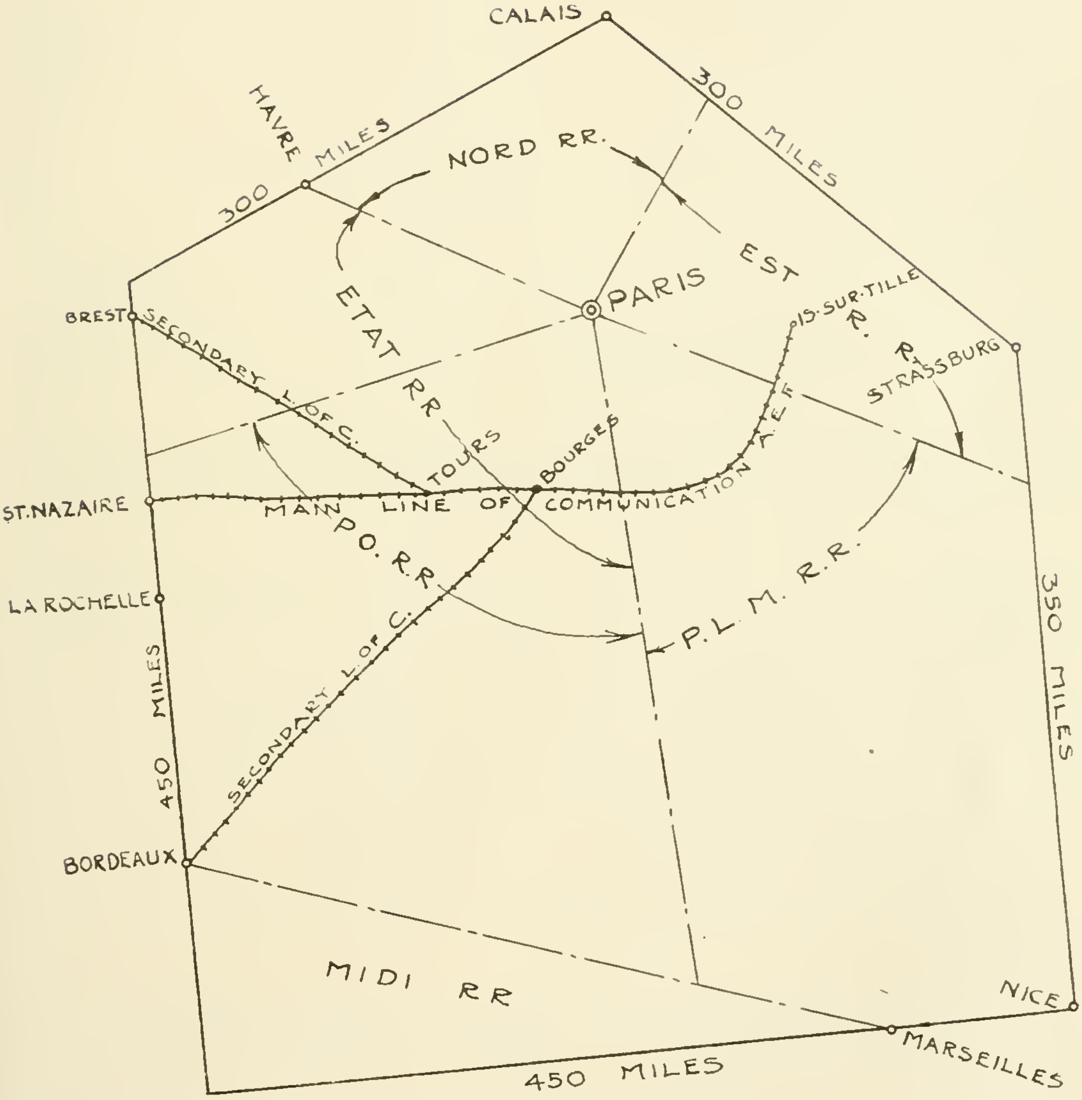
THE RAILWAYS OF FRANCE

By Charles Weiss, '13, Assistant Supervisor P. R. R.
Formerly Captain Engineers U. S. A.

First impressions are often-times radically modified by further observation and reflection. Thus an American landing in France, sees the small, toy-like railroad cars. He sees a brakeman step in between the cars to couple them, and give a signal with a little horn. Thoughts of the fine big American rolling stock come to his mind, the powerful engines, the many other more modern features, that make him feel both pity and contempt for the railways of France. After a few months stay in France, the difference in conditions that exist in the two countries becomes more apparent, as well as the results achieved by the carriers of the former, and with it a greater respect for them.

A few remarks concerning the geography of France will help us to better understand the transportation question. France lies between the 42nd and 50th parallels of latitude, or opposite Nova Scotia and Newfoundland, but has, needless to say, a more equable climate throughout and a smaller seasonal variation in temperature than we are used to. This condition tends toward national uniformity in her railroads as well as in other matters. The sketch very roughly indicates the size and shape of France. Paris in addition to being the political, social and economic "heart" of France, is also the "geographic heart" and the heart of the national transportation scheme. The distances given make it evident that travel in France is on the average for much smaller distances than in our own vast domain. A ten hour trip there is considered a long one, and therefore passenger coaches are not "rolling dwellings," nor freight cars rolling warehouses as in North America. The sketch shows the six major systems. Each has a certain sector of the country to itself, free from competition. There is but one exception to this. With but one exception, the "Midi," they all terminate in Paris. With but one exception they are privately owned and operated. That one, the "Etat" which is owned by the national government, is the most inefficient and antiquated of all. Another system, the "Ceinture" or belt might be added. It is a double belt line around Paris, and is jointly owned by the other lines. In contradistinction to the Etat, is the P. L. M., usually considered the "standard railroad of France." We therefore find that in place of the trunk lines extending straight across the country, that we are familiar with, the French have developed the radiating type. This naturally complicated the problem of transporting the enormous personnel and material of our own army from the west coast to the battle lines in the east. Supplementing this vast mileage of standard gage lines is an enormous network of narrow gage for both freight and passenger service, that reaches everywhere. A considerable tonnage is also carried through the widespread canal system. The national highways are perhaps the finest developed of any nation. Needless to add, military strategy and necessity have had a preponderous influence in the development of all these diverse systems of arteries. That perhaps accounts for the existence of considerable double track through territory, which under normal conditions could not support a single track line.

The *human equation* must also be considered in a discussion of a utility that to so large an extent enters the every day life of the entire population. While the French may be called the Americans of the old world, they differ in many respects from us. Although perhaps the least Latin in temperament of all the Latins they nevertheless are lacking in what we call "pep." They are slower, but on the other hand more thorough. Having once unravelled the frightful amount of red tape met everywhere, they carry a project through to completion, for all time. For this reason one rarely sees an abandoned right of way in France. Our method is to build cheaply and quickly, improving and changing as conditions warrant. They build for permanence. When interest charges warrant, we reduce grades, improve and extend lines, but in France everything is made standard from the very beginning. The dense population and national thrift of the French do not permit any waste of land, and we therefore find the fields cultivated to within five feet of the tracks. Side and overhead clearances are also reduced to a minimum. The French devote great attention to detail, and are very ingenious. This fact leads to the use of many devices in equipment, which could not, however, be used on our heavier equipment. There seems to be greater co-operation between the travelling public and the railroads in France and the former does not have to be continually goaded into obeying regulations which are for the benefit of all. It was indeed gratifying to see with what energy, hope, and courage the French began to restore their railways and roads immediately upon the termination of hostilities. The ravages of the war upon these and other necessities of national life will be evident for some time to come. Three billion francs, however, have already been appropriated towards the rehabilitation of the 3500 miles destroyed by the Huns, a considerable portion of which is to be electrified. This characteristic demonstrated before in her history, convinces one that although battered for five years, France will rise from the struggle, a superior nation in energy, stamina and character. In fact she is setting an example in reconstruction that other nations would do well to follow. One is tempted to call it all higher patriotism. One sees it in the beauty of everything artificial, made to harmonize with the



SKETCH SHOWING RAILROAD DIVISIONS OF FRANCE works of nature. Utility has not, however, been forgotten, and we find not only beautiful but well-designed bridges and highways. The same characteristic permeates all life. There is no barren land. Splendid forests abound. Scientific breeding is the common practise. In transportation matters, to those skeptical of French achievment, a few random results obtained will be stated. The fastest trains in the world run from Paris, in several directions. The St. Lazare station in Paris is the busiest terminal in the world. During the war, although the French lines of communication had to serve the other allies as well, troop trains were run at ten minute intervals regularly, and some of these trains carried as many as 2000 men, and were loaded in about five minutes' time.

War Time Operation. With the outbreak of the war, all French lines were automatically taken over by the government, and operated by a bureau of the war department. All details have been worked out in a comprehensive study, extending over many years. Every link in the vast system is co-ordinated in a ponderous schedule. Without any last minute preparedness, the entire armed strength, active and reserve of the nation, can be mobilized, and moved with no waste of time or equipment. This condition, aided by an adequate highway system, did upon one occasion, at least, save the war for France and the allies. How different from our own methods! Before our entry into the war, our entire knowledge of military transportation was vested in an insignificant part of the Quartermaster department. Our ideas were vague and inaccurate on this vital topic. After a considerable lapse of time, and frequent radical changes in organization, an efficient scheme was finally developed. Then came the end of the war, and with it the practical end of the transportation corps. The result will be, that should we ever have another war, we will start bungling all over again, and pay the price in human lives.

Peace Time Operation. French operation is left-handed; in other words, trains pass on the right. The most important and almost universal criticism made by Americans is their lack of an adequate system of dispatching. Such dispatching as is done is under the direction of the station agent, who is a sort of division superintendent. His territory extends approximately half way between adjacent stations, and he controls train movements between these points. He does not usually know the location of trains not on his territory. This causes considerable delay, both on the road and in terminals. There is furthermore very little co-operation between the operating and the motive power departments, so that train and engine crews are frequently called for different times. "Sight reports" of business in sight are not commonly known, and this leads to waste of both man and motive power. "Single-lining," or running of trains against the current of traffic is very rarely practised, although the other track may be open. The small equipment makes it possible to do all local station switching by hand, or with the aid of a horse. Smll turntables are very common, at all stations, for the use of cars. Trains are protected by flagmen, but by obtaining a "receipt" from a crossing watchman, who may live at the next kilometer post back, this important duty can be delegated to some one else. Equipment is very carefully handled by crews.

Station and other Facilities. The uniformity of French railways is strikingly illustrated in their stations. They are universally of masonry, with the same interior arrangement for stations in communities of the same size. The track layout is also standard, including long platforms, from which cars can be loaded directly from vehicles. The flexibility made possible by use of the small turn-tables, permits flat cars to be end-loaded. Slip switches, humps, interlocking plants, clearance gages, movable cattle chutes, scales and cranes are found at all but the least important stations. Yard and terminal facilities are very frequently inadequate, causing considerable delay, even to through trains. Passing sidings are also infrequent, and are usually of the "pull-up and back-in" variety.

Rolling Equipment. Locomotives and cars are both smaller and lighter than our own. The engines show fine workmanship, and are very smooth riding. They are nearly all compounded, equipped with superheaters and copper fireboxes, so that their fuel consumption is low. The fuel consists of compressed coal in the form of briquettes, and has a high calorific value. The air-brake, throttle, and levers are not as convenient or efficient as on American engines. The engines have whistles, but no bell. Passenger cars and about forty per cent of the freight cars are equipped with air. The others are equipped with screw or lever brakes. The French are, however, very loath to use air on freight trains. Since their trains are rarely over 600 tons, by placing cars to be used for braking purposes at regular intervals in the train, operation is not rendered less inefficient. The automatic coupler is apparently not known in France. All cars have a set of steel bumpers at each end as well as a set of safety chains to hold adjacent cars together in case the couplers fail. Freight cars have two wheel trucks with leaf springs, but passenger cars are supported similarly to our own. They are of the side door and end door type, all divided into compartments. The desired privacy, is, however, not obtained. First class coaches are not as comfortable as our parlor cars, while the third class is inferior to our second class transportation. The length of cars varies from 25 to 80 feet. Only the newer cars are solidly vestibuled. Through trains carry sleeping cars, which are owned by an international company. The rates are exorbitant, however. Dining car service is splendid. Table d'hote meals are served at reasonable prices. The absence of vestibules makes it hard for the train crew to pass through the train, and one therefore rarely sees a conductor. However, due to the heavy penalty of boarding a train without a ticket, very little free unauthorized travel is noticed. Train schedules do not change as frequently as ours, but it is necessary to purchase time tables. The free baggage allowance is much smaller than on American roads, but the rates are low. In fact, travel in France is cheaper than in most continental countries and Great Britain.

Track. The standard gage is the same as ours. The rail is usually bulb shaped, and much lighter. It rests on chairs, to which it is tightened by means of either iron or wooden wedges. Screw spikes are universally used. In certain sections one finds the ties notched, and the rail resting upon strips of compressed wood fitted into these notches. Ties are thus made to last a generation, under very fast and dense traffic. In fact everything is put in to stay. All the ditches and culverts are of masonry, artistic and adequate in design. Ties are small in section. Nearly all ballast is stone. Joints are not staggered, but placed opposite each other. The use of derails is common. Curves are based upon radius in meters and not upon degrees of curvature. Clearances are as low as six inches from tops and sides of cars, but the added degree of danger results in surprisingly few accidents. There were probably over one hundred accidents to American soldiers, who insisted upon riding tops of freight cars despite all warnings. Bridges are well and beautifully designed. Grades are more often separated than in the United States. Where grade crossings do exist, one finds strong gates, locked with a key, and under the supervision of a watchman, who lives right at the crossing with his family.

Signals. The absolute block system is in almost universal use in France. The signals are of the banjo, checkerboard and semaphore variety. Occasionally one does find caution signals. All signals are mechanical, thus requiring an enormous amount of wire. The mechanism is not as well protected against failure as one would expect. Whistle signals are also used by trains but not as effectively as in this country. The conductors, brakemen, and station agent each have a distinct type of whistle or horn, which they use in place of lanterns or hand signals. Safety first is a subject that receives but little attention in France, but apparently is not so necessary there as here.

Labor. The cheapness of manual labor is very apparent, from the absence of labor saving devices. Even in the shops of moderate capacity one rarely finds travelling cranes, pneumatic hammers, coal chutes, or other electrical, mechanical or pneumatic devices, common to most American shops. The French artisan is, however, diligent and thorough. This is seen in all his products. The excellence of the roadbeds proves it, for after five years of deferred maintenance its condition, and the good riding quality of the track it supports, were superior to those of American roads. Much of the.labor employed consists of the lowest element of the population. Most classes are now organized into so called "syndicates," the tyranny and autocracy of which are casting heavy shadows upon the industrial horizon. Station employees as well as all trainmen are arrayed in uniforms. Some of these, particularly that of the "Chef de Gare" or station agent, is a rather gaudy affair, although not as much so as that of his neighbor, the Italian agent. Most of the employees are courteous, and rather dignified in the performance of duty.

Lines of Communication of the A. E. F. Lines of communication were developed by the transportation corps of the A. E. F., under the direction of Brig. Gen. W. W. Atterbury, Vice-President of the Pennsylvania Railroad. In an endeavor to get a trunk line, use was made of portions of four of the systems previously referred to. The main line extended from St. Nazaire, the large American port, on the west coast, in a westerly line, through the enormous depot of Gievres, where the A. E. F. had built about 130 miles of track and warehouses to hold six months' supplies for a million men, to Is-Sur-Tille, another enormous depot in the advance section. A secondary line was operated from the port of Brest to the main line at Tours, and another from the port of Bordeaux to the main line at Bourges. An emergency line to relieve congestion on the main line was opened up, parallel to the central portion of the latter. Still other lines were either operated or under contemplation, from the ports of La Rochelle, Havre, Marseille, and Cherbourg. The detailed organization and operation of these lines will undoubtedly be told elsewhere. The purpose of these notes is merely to call attention to a few generalities, and to show that the railroads of France as a whole must be included among the decisive factors that "won the war."

THE PLAGUE OF TECHNICAL LITERATURE*

By Clinton L. Bogert, '05.

The engineer of to-day is busied in so many industries that the engineering papers which aim to serve him have a very extensive field to cover, and must be so edited as to anticipate the needs of the greatest number of readers. To do this, the editor must dip his pen first here, then there: into the ink-pot of electricity, of steam machinery, of water supply, of hoisting machinery, of reinforced concrete, etc. A paper that covered but one specialty would have limited circulation, and hence, small standing. The specialist is often disgruntled because a whole issue may be given up to matters in which he has no more interest than a Fifth Avenue tailor has in the pickings of a Riker's Island scavenger. Much matter appears in the engineering papers which is of importance only to one who is pursuing a problem to its last detail. For a man to wade through such matter at a time when he had no use for such information would be futile. But a time may come, although at present unforseen, when this matter will be valuable to the person who hurries over it to-day. And when that emergency comes, the prudent engineer is provided with the means for meeting it.

The number of engineers who read the engineering papers regularly and systematically is surprisingly small. Many engineers object that the reading of so many weekly and monthly periodicals takes altogether too much time. After graduation, the writer started reading the engineering papers regularly. In the beginning it took the writer 1.5 hours for each of two civil engineering periodicals; these same papers can now be digested in half an hour each. Do not believe that every article is read thoroughly during this time; yet he is able to get from the magazines the news and the conclusions during such a reading. The writer has half an hour on the train each morning and he finds this the opportunity for doing his technical reading. The fresh and avid mind of 8 A. M. is capable of more understanding than is the dust-fogged mind of 5 P. M. The practical man immediately asks if the daily papers are read. Yes, this is done on the night-trip. The writer never contracted the newspaper fever, and one paper per day suffices him.

The writer subscribed to an engineering paper in his second college year, being led to it by alluring rates to students. He thought as highly of his investment as did Mose of the green goggles. He liked to see the issues lying around; they gave a technical atmosphere to his room. The papers were of no practical use to him beyond this decorative value. His was a physical ownership only; beyond the information gleaned from scanning the photos (while waiting for the dinner bell) and picking out the more alluring ads (especially those offering free catalogues), he knew nothing of the contents. After graduating he perceived the danger of the little knowledge acquired at college, and came to the conclusion that the title Civil Engineer must be perpetually striven after to be maintained in one's possession, just as any intercollegiate trophy. Engineering is in such a state of evolution that only by constant observation and reading can the mind evolve with it. The engineering periodical is a necessity for self-preservation in the ranks of the profession.

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*From notes written in 1905.

The writer is minded of an office employing two score engineers, 80% being college bred. Observation has shown these college-made men to be most lax in their attention to current literature. They pay their few dollars subscription money (when they can no longer avoid so doing) with a religious sigh, at the same time making a mental calculation of equivalent values and reckoning up the theatre tickets, books or what not sacrificed. After having thus paid and sighed, they stack the incoming numbers at the back of their desk and allow the dust to collect until they change their job, when the accumulation is put into the waste basket—an utter waste. To them, technical literature is a burden. Why should they examine the contents? They possess the talisman C.E., which surely ought to ward off any impending dangers from ignorance of modern methods. On the other hand, the engineers made elsewhere than within ivy-coated walls feel no such security. Most of them regularly read the periodicals and are always striving to increase their knowledge.

Wide-awake reading of technical periodicals should be the every day duty of every professional man. Every article appearing in technical periodicals (at least, in the best regulated ones) is there because of the novelty of the thing described. The reader should always remember that the article was published for a reason and that it is up to him to find the reason and put it on an index-card, or make a mental memorandum of it, or avail himself of some system of classification. The writer finds it most advantageous to mark the important disclosures in the text with a colored pencil. With such an intention in mind, the spirit of the huntsman becomes operative and serves both to stimulate the attention and to blaze a trail through an otherwise trackless article. This trail, moreover, will be found a great time-saver in making future references to the article. By so treating the technical magazines, a burden is turned into a tool.

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EDITORIALS

In This Issue After the failure to meet the approval of the voters of two schemes for the provision of flood relief for the Scioto River Valley involving expenditures of eight and one-half and ten and one-half million dollars, respectively, a proposition for the appropriation of three and one-half millions to the work of improving the channel, as a means of flood relief, was passed upon favorably. Mr. R. H. Simpson, '96, was placed in charge of the work and in this issue of THE CIVIL ENGINEER he outlines the controlling conditions of the problem and describes the project. Mr. Simpson's article will be found on page 157.

On page 164 Mr. C. H. Pierce presents in a concise way the fundamental considerations in the accurate determination of stream-flow data, both for open-channel gaging stations and for stations at dams and power plants. His suggestions are of especial value and interest because they are based upon the accumulated experience of that agency which has made such vast and important contributions to stream-flow data in this country, namely, the United States Geological Survey, of which he is a District Engineer in the Water Resources Branch.

Mr. D. O. Stone, '09, contributes an interesting description of the organization and forms used by the Ohio State Highway Department in its systematic bituminous surface treating work. That the importance and necessity of this work was early recognized by the Ohio State Department is evinced by the fact that the Maintenance and Repair Bureau, of which Mr. Stone is Maintenance Engineer, has been in existence nearly ten years. That the work is well organized and efficiently carried on is from Mr. Stone's article also evident. Included in this article are the forms used for surface-treating-work reports and records and a photograph of the folding camp-trailer which forms a part of each outfit. This article will be found on page 170.

Of the many things in France which have been the object of misapprehension and misunderstanding few have been more misunderstood or underestimated than the railways of France. That they are pathetically primitive and hardly to be compared with our excellent American railway system is certainly true. It is none the less true, however, that we Americans can profit a great deal from French example in the operation of their inefficient system. As Mr. Charles Weiss, '13, says in his article on page 179 of this issue, the results achieved by the carriers of France force us to radically modify our first impressions of French railways and to hold them in greater respect. Mr. Weiss was a Captain in the 66th Engineers (Railway Operating) and is at present Assistant Supervisor with the Pennsylvania Railroad.

On page 186 Mr. Clinton L. Bogert, '05, makes some very pertinent suggestions (which, by the way, were written in 1905 but are just as pertinent today) regarding the importance to the engineer of reading and pigeon-holing, in some way, the literature appearing in the technical publications of the day. Mr. Bogert is with Mr. Clyde Potts, '01, Consulting and Sanitary Engineer, of New York.

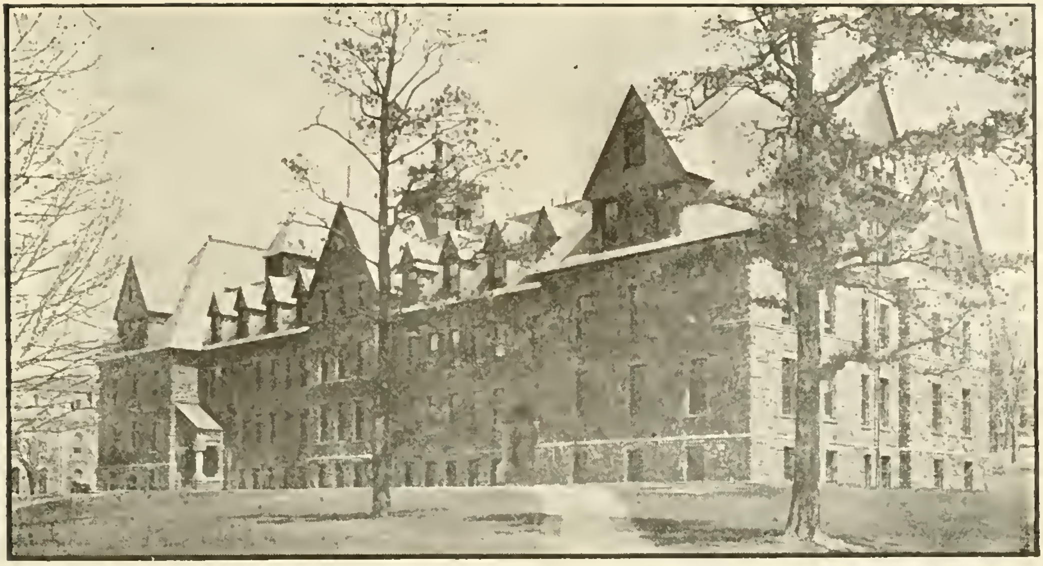
The Honor System

Shall the Honor System in the College of Civil Engineering be abandoned? This is a question which has probably had to be settled at least twice during each college generation since the institution of the system by the class of 1907. It is again before the student body of the College. The system has the hearty support of the faculty *if it works*. A system which plainly does not work is certain to be speedily abrogated, for the Cornell degree can not be cheapned by permitting courses to be passed only by the friendly aid of a dead honor system.

But the Honor System in C.E. is rather dormant than dead. It needs to be shaken up and brought to light and talked about. It must be realized that no honor system can be a success unless each individual student is made to feel that he is responsible for its success. "Passing the buck" by electing or appointing an Honor System Committee and straightway forgetting that the System exists is what has made it only an indifferent success in the past. When every man in the College considers himself a member of the committee and is willing to discharge his responsibility the System will be an unconditional success.

There can be no question that the most perfect honor system is found where there is the most general healthy sentiment against cribbing and cheating. There is no group of college men in which this sentiment will not naturally develop when naturally stimulated. One of the very best ways to encourage it is to promote college interest and college pride. From these evolves a feeling of solidarity which affords most natural and fertile ground for the development of so strong a sentiment against cheating that the man who cheats will find himself ostracized by the undergraduates of the College.

A greater college pride and a greater interest in the College are, then, what we need. Why not hang another Intercollege Athletic Championship banner in the library? Why not get acquainted with the men in the College—faculty members and students? Why not get behind C.E. get-togethers and make them the talk of the Hill? Why not revive the College Banquet? We can do these things. Let's boost! And then we will *have* an Honor System.



COLLEGE NOTES

Princeton vs. Cornell

The first intercollegiate league game for Cornell's basketball quintet was played in the New Armory, Friday, evening, December 19, 1919, against Princeton. Despite the fact that many students had already left for the holiday vacation, a record number attended the game. The band also made its second appearance at this game, which proved to be a fast one from start to finish. At first the Red and White men clearly outplayed their opponents. During the first half the lead alternated between the two teams. In the second half our team was able to tie the score but once and never attained the lead, due to an improvement in the team work of the Princeton team. This improvement in form coupled with superior goal shooting abilities forced Cornell to defeat. The final score was 25–19 in Princeton's favor.

Bucknell vs. Cornell

The Varsity defeated Bucknell by a score of 36–25 on January 7th, 1920, in the New Armory. Porter proved to be the heaviest scorer in this game and Captain Molinet made a number of sensational field baskets. On the whole the game proved to be rather a one sided affair, the visitors gaining the lead but once during the first part of the game. After this they lost ground by attempting too many long goals.

Union vs. Cornell

The Cornell team showed much improvement both in team work and individual playing in the Union game of January 13th on the New Armory court. This stood them in good stead in their hard fought victory over their opponents to the score of 30–18. Although our team took the lead and maintained it throughout the game, this lead was far from being comfortable due to the hard work of the Union players.

Detroit Symphony Orchestra Concert

The third of the University pre-festival series of concerts was given by the Detroit Symphony Orchestra of 90 pieces in Bailey Hall, Saturday evening, January 10th. The conductor, Ossip Gabrilowitsch, who played here several years ago as a well known pianist, has earned a place among the foremost musicians of the world by his able leadership in developing the orchestra to its present degree of excellence.

The Hall was thronged with people who received the selections with genuine enthusiasm. The audience spoke in praise not only of the music they heard but also of the organization that they saw perform.

Corduroy Pants Day

January 14th was the official "Corduroy Pants Day" for seniors of the University. The wearing of corduroy by the class of 1920 marks an attempt to inaugurate a new senior custom at Cornell. In recent years, blazers were tried, as were sailor suits, but neither survived a single season. President indications, however, predict a happier future for corduroys.

Vacations

With the return to the University of pre-war conditions, the vacations this year have resumed their normal length. The Christmas holiday recess began on December 20, 1919, and instruction was resumed on January 5, 1920. The first term examinations begin on February 2, and second term registration takes place on February 14, thus alllwing the C. E. students about a week's vacation.

The Easter vacation commences on March 31, and ends on April 6. On Saturday, May 22, comes Spring Day, with the usual Spring Day events, including a crew race with Harvard, a baseball game with Yale and a concert by the Musical Clubs.

Junior Week

The first Junior Week held at Cornell since the war will open on Wednesday, February 11, and guests will depart on Sunday, February 14. The official program for the week is as follows: Wednesday, concert by the Musical Clubs, Sophomore Cotillion; Thursday, two performances of a play by the Masque, at the Lyceum Theatre; Friday, Junior Prom; Saturday, basketball game between Cornell and Yale. In addition to these events there will be numerous House affairs, which will take up the time of the hosts and their guests.

C. E. Smoking Room

The large room at the north end of the Lincoln Hall Basement can now be used as a lounging place and smoking room whenever no class is meeting there. As this room is equipped and used as a testing materials laboratory, with a concrete floor and brick walls, danger from fire is entirely eliminated. In addition to the privilege of enjoying a smoke there, without hiding the cigarette whenever a member of the faculty approaches, we can enjoy a little music in our spare time; for a piano has been rented and placed in the room, and there is never any lack of performers.

The movement to secure this privilege was initiated by the C.E. Association of which H. J. Benisch, '20 is president and B. J. Harrison, '20 is treasurer; the Association is also paying the expense of furnishing the piano, and intends to hold numerous get-togethers and smokers making full use of this asset. The first of these is scheduled for Monday, January 19, following an illustrated lecture by Henry R. Lordly, '93, in Room A, Goldwin Smith.

Intercollege Basketball

The Intercollege Basketball Season is developing some very keen competition between several of the college teams. Civil Engineering, Agriculture, and Veterinary have each won two games and lost one, while Chemistry is still undefeated; the Chem. five, however, has not yet met any of the stronger teams of the league, having defeated the teams from the Colleges of Law, Architecture, and Mechanical Engineering.

The C.E. Five beat Arts in the first game of the season, lost to Agriculture by one point, and on January 13 easily defeated the Sibleyites by the score of 24–16. The men usally playing for C.E. are: Shreiner, Rice, Stalker, Karnow, and Becker (capt.); and, judging from the results so far, there is every reason to believe that this team will capture the Intercollege Basketball Championship for 1919–20.

Indoor Track Meets

For a number of years Cornell has been handicapped by a lack of proper facilities for winter training. The board track and the baseball cage have been used in the past and while the teams have shown up well in the spring because of the outdoor work, it has been impossible to schedule any meets here. One of the best ways to improve is by competition and heretofore when Cornell took part in any meets during the winter they were away from home. This has been remedied now.

The new New York State Armory completed in 1917 and used by the government during the war was turned over to the University last year. It has been used for Basketball games and now it is planned to hold indoor track meets there. A ten-lap track has been installed and it is planned to change this later to an eight-lap track. The Saturday meets are being held there at present and are proving very successful.

A meet with Michigan has been scheduled for March and other meets may also be scheduled. These meets will give the men a chance to encounter some real opposition and will also give the students a chance to see the team in action. This competition ought also to better fit the men for the Spring meets and strengthen our chances for bringing home the Intercollegiate Championship for the sixth consecutive time.

ALUMNI NOTES

'77. John N. Ostrom has left Pittsburgh, Pa., and is now living at East Randolph, Cattaraugus County, N. Y.

'87. George H. Norton resides at 62 Tillinghast Place, Buffalo, New York.

'88. Orville Benson, who was lately discharged as a Major of Engineers, is now with The American Bridge Co., at Pequannock, N. J.

'01. Major E. B. Whitman, who has recently returned from a three months professional trip to Poland, recently visited the college.

Col. Ralph F. Proctor, '01, and J. W. Heller, '01, also were recent visitors.

'03. A. R. Keller gives his address as Pleasanton Hotel, Honolulu, T. H.

'05. Thomas Fleming, Jr., has withdrawn from the firm of Chester & Fleming to become associated with the Oil Well Supply Company.

'06. R. H. Knowlton gives his address at 211 Cornell Ave., Swarthmore, Pa.

'07. Lieut. J. A. Silsbee gives his address as Edgewood Arsenal, Edgewood, Md.

'08. Juan E. Aguilar of Heredia alta 3, Santiago de Cuba, has sent us greetings for the new year from the firm of Chalons & Aguilar, Engineers and Contractors, of which he is a member.

'09. R. Y. Thatcher is Civil Engineer for the Lackawanna Steel Co., Buffalo, N. Y. His address is 20 Wellington Road.

'10. I. Ellis Behrman is a Major with the U. S. A. Engineers. His home address is 1121 E. Baltimore St., Baltimore, Md.

'10. A son, David Lynn, was born on August 30th, to Mr. and Mrs. Lynn Crandall of Jerome, Idaho.

'10. R. B. Daudt is Chief Engineer with the A. Bently & Sons Co., Toledo, Ohio. His address is 2629 Robinwood Ave.

'10. S. August Kalberg gives his address as 147 Milk St., Boston, Mass.

'10. Edward H. Leggett of No 8 South Allen Street, Albany, N.Y., is employed by the Ludlum Steel Company, of Watervliet, N. Y.

'10. L. M. Levine, who served as First Lieutenant with the 26th Engineers, was discharged last spring and is now in charge of engineering design and construction for the J. H. Ladew Co., tanners of sole leather. of Newark, N. J. His address is 539 Manhattan Ave., New York City,

'10. Percy S. Monk was married on September 27th to Miss Mary Virginia Ehrhardt of Augusta, Ga. Monk is a Structural Engineer with the Division of Valuation, Interstate Commerce Commission, Chattanooga, Tenn.

'10. F. L. Stearns has removed from his address at 173 Hicks St., Brooklyn; his present address is unknown.

'10. Major Roy Taylor has been discharged from service and has returned to his former position with the Munson Steamship Co., 82 Beaver St., New York City.

'11. W. M. Aitchison gives his address at 18 King St., Morristown, N. J.

'11. H. A. Vanderbeek, until recently located at Shanghai, China, is now living at Somerville, New Jersey.

'11. James R. Webb is with the Turner Construction Co., at 244 Madison Ave., New York City. His home address is 75 Northern Ave

'12. E. G. Edwards of 3341 Bryant Avenue South, Minneapolis, Minn., is a Highway Engineer for the Bureau of Public Roads of that city.

'12. Elmer Heubeck gives his address at Fifth Avenue, Rognel Heights, Baltimore, Md.

'12. M. L. Kaufman was married on October 31st, to Miss Pauline Plaine at Brooklyn, N. Y.

'13. Harold T. Canfield is Assistant Construction Engineer with Charles H. Tenney & Co., Boston, Mass. His home address is 183 Harbard Ave., Allston P. O. Station, Boston, Mass.

'13. C. Reid Johnson is still in service as Lieutenant in the Civil Engineer Corps, U. S. N. He has recently been transferred from the Naval Operating Base, Hampton Roads, Va., to the Submarine Base, New London, Conn., as Assistant to Public Works Officer.

'13. Harvey T. Munn has changed his address from Washington, D. C., to 1016 Monroe St., Wilmington, Delaware.

'14. Philip T. Coffey is in the Metropolitan Department of the Atlas Portland Cement Company, 30 Broad Street, New York City; he is living at 66 Orange Street, Brooklyn, N. Y.

'14. Professor N. W. Dougherty is head of the Civil Engineering Department of the University of Tennessee. His address is 1011 Irwin St., Knoxville, Tenn.

Ex '14. Austin S. Hart gives his address at 2101 Adelbert Road, Cleveland, Ohio.

'14. Paul L. Heslop is in charge of surveys on the Jordan Valley Irrigation Project, for Barr and Cunningham, Consulting Engineers of Portland, Oregon.

'14. Major J. A. W. Iglehart has received his discharge and is now Manager of the Baltimore Office of Brooke, Stokes and Co., Bankers, Members of the Philadelphia Stock Exchange. His address is 102 St. Paul St., Philadelphia, Pa.

'14. John M. Phillips is with Clyde Potts as Resident Engineer on the Jersey City Duplicate Pipe Line. He gives his address as Lathrop Ave., Boonton, N. J.

'14. Major E. U. Ragland gives his address at 228 West Fisher St. Salisbury, N. C.

'15. Porter V. Hanf has resigned his commission as First Lieutenant of Engineers. His address is P. O. Box 97, San Bernardino, Cal.

'15. C. L. Maas is now living at 5848 Florence Avenue, Philadelphia, Pa.

'15. J. R. Rosenfeld was married on June 30 to Miss Bertha C. Rank, of Pittsburgh, Pa. They are living at 5621 Northumberland Ave.

'15. Charles F. Starr, of 64 Rowley Street, Rochester, N. Y., is an engineer with the Genesee Bridge Company.

Ex '16. Harold Jay is with the Acklin Stamping Company, 1645 Dorr Street, Toledo, Ohio.

Ex '16. Ensign L. T. Reinecker has been placed on the inactive list of the Navy and is now working for the Highway Department of the city of Baltimore, Maryland.

'17. C. B. Benson is at Cornell University, teaching Mechanics in Sibley College.

'17. Charles A. Hoffman is with the Advertising and Sales Promotion Department of the Vanity Fair Silk Mills of Reading, Pa. His home address is 1352 Perkiomen Avenue, Reading, Pa. He writes that a daughter, Dorothy Chapman Hoffman, was born on July 26, 1919. Mrs. Hoffman, before her marriage, was Margaret L. Chapman, Cornell, '18.

'18. Juan M. Bertran has returned to his home and may be addressed at P. O. Box 62, Humacao, Porto Rico.

'18. A. Mulliken has accepted a provisional appointment as Assistant Sanitary Engineer in the New York State Department of Health.

'18. M. A. Valderrama has re-entered the employ of the Mergenthaler Linotype Company, Tribune Building, New York City. He is now traveling in the West Indies and will go from there to South America.

'18. Carl H. Walker is working for the Water Supply Department of the City of Baltimore. His address is 1028 Cathedral Street.

Ex '19. Daniel L. Dargue, who discontinued his course to enter service, has been awarded the Distinguished Service Medal for faithful and especially meritorious service in this country. Dargue was a First Lieutenant in the Air Service and served for some time as an instructor in the U. S. Army School of Military Aeronautics at Ithaca. He was discharged on July 23 and expects to return to Cornell to complete his course.

'19. G. S. Hiscock is with the McClintic-Marshall Construction Co., at their Rankin Plant near Pittsburgh, Pa.

'19. Nee Sun Koo was recently elected to the Honorary Scientific Society of Sigma Xi.

'19. John H. McClure may be addressed in care of The Texas Company, Port Neches, Texas.

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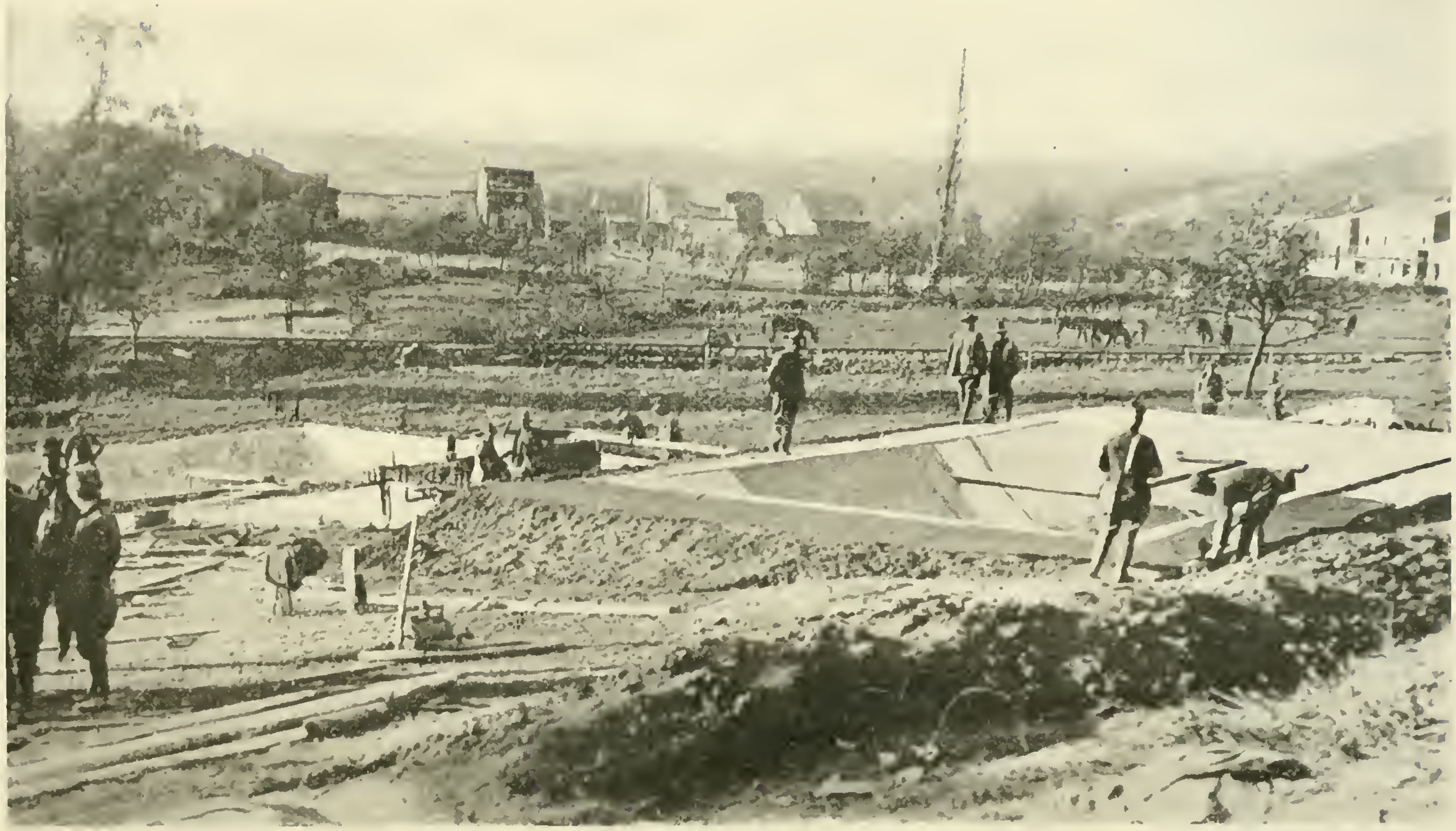

Water Purification Plant at Euvezin (St. Mihiel Area)
This was one of the most ambitious works of the Water Supply Service at the Front

THE CORNELL CIVIL ENGINEER

and

Transactions of the Association of Civil Engineers
of Cornell University

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Vol. 28 FEBRUARY, 1920 No. 5

KEEPING THE FIRST ARMY SUPPLIED WITH WATER[1]

By Lieut.-Col. F. W. Scheidenhelm , '01

Ammunition, water, food—all are essential to keep an army in fighting trim. Ammunition is essential for fighting, water and food are essential for *efficient* fighting and for life. The individual soldier or animal feels the lack first of water, then of food. Depending upon the availability of other means of transportation, water was at times given priority over ammunition as regards transportation over the narrow gauge railways at the front.

The problem of water supply at the front is simple in detail. The quantities of water handled at any one place are small. The difficulties are due rather to the extent of territory to be covered and the speed necessary in making supplies available.

Aside from the necessity of having a general familiarity with matters of hydraulics, of having the water supply point of view, so to speak, the engineering work involved is really of elementary character. No reference books were necessary except, perhaps, a table of friction losses in pipe. Executive and organization work, on the other hand, stood out as of prime importance. In fact the water supply work at the front might well be characterized as "rough and ready,"—*rough* because it had to be *ready* for the arrival of certain troops or for some other contingency.

The water supply along the American front was the responsibility of the Water Supply Service of the field armies. The present discussion deals with the work of the Water Supply Service of the American First Army. Its responsibility covered water for men, for animals, for railways, both standard and narrow gauge, and for hospitals, including field and evacuation, but not base, hospitals. Under campaign conditions the Engineer Department of the U. S. Army is responsible for water supply. Under pre-war regulations responsibility for quantity only was contemplated, but under the regulations adopted for the American Expeditionary Forces, the responsibility of the Engineer Department, of which the Water Supply Service formed a part, was extended to include quality also. The responsibility for quality, however, extended only to and including "water points," as will be explained in more detail.

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[1] Revised notes of an informal address at the Buffalo convention, June 12, 1919. The author was in charge of the water supply service of the First Army, A. E. F.

Reprinted from the JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION, Vol 6, No. 4, November, 1919

Prior to the recent war such a thing as a Water Supply Service was unknown. It was the great densities of troop concentration that brought into the forefront the need for such a Service. The French in 1915, and soon thereafter the British, were the forerunners in establishing special services for this purpose. Profiting by their experience the American Expeditionary Force prepared in its early stages to set up its own Water Supply Service. What troop density means may perhaps be better appreciated after considering that a common density prior to a great attack involved 100,000 men with, say, 35,000 animals, all crowded into an area having a front of three miles and a depth not exceeding seven miles.

The principal areas involved in the American concentration prior to the St. Mihiel drive supported a pre-war population of about 25,000 civilians. These same areas during the concentration supported a military population of about 600,000 men, together with nearly 200,000 animals. The pre-war water supply was none too ample for parts of the region. In fact, those very parts where troops were to be crowded most densely had but little potable water, especially during the latter part of the summer season. The supply of drinking water in the region, therefore, had to be increased to something like twenty-five times its earlier capacity. Even the four years of military occupation of the area preceding the St. Mihiel drive had resulted in increasing the supply to only about six times the pre-war supply

The Water Supply Service of the American Expeditionary Forces centered around the 26th Engineers, a regiment especially organized, largely by means of volunteers, for water supply work. A number of its officers were detailed from time to time for headquarters and other staff work. Thus Major (subsequently Colonel) F. F. Longley, a member of this Association, was sent to France in advance of the water supply troops and remained the principal officer of this Service at the headquarters of the Chief Engineer, A. E. F.

The need for water supply troops in France resulted in scattering the several companies of the 26th Engineers over various parts of the area of the Services of Supply, beginning as early as November, 1917. It was not until May, 1918, that the first of the water supply troops reached the front north of Toul; but even so, they were ahead of any American forces operating independently. As the American First Army got under way in its St. Mihiel and Argonne-Meuse operations, a maximum of four companies of the regiment were gathered into that Army, and these, together with a large number of attached troops, formed the Water Supply Service of the First Army.

These Water Supply troops were army troops, that is, army troops as distinguished from the troops of divisions or of army corps. Their work was one of service for the divisions, the corps troops, and the other army troops; in fact, of service for the army as a whole. The head of the service was known as the Water Supply Officer, Army, reporting to the Chief Engineer, Army. This was the position held by the speaker, who in due course became commanding officer of the 26th Engineers in the field.

Water along the front is essentially an *area* matter, that is, water supply installations are ordinarily "tied to the ground," so to speak. Therefore the army area was divided into sectors and these in turn into districts. So far as practicable the districts corresponded to the tactical areas of the corps (composed of a group of divisions). As the front advanced, the districts naturally became extended in depth and the difficulties of covering the territory increased correspondingly.

The *modus operandi* was essentially one of wholesaling water to the tactical organizations, that is, to companies of infantry, batteries of artillery, etc. These organizations called for their water in wholesale at the "water points," that is, points where water was made available to all comers. Beyond the water points the organizations themselves were responsible for the transportation of the water to their own troops, by means of water carts, hand containers, and what not. In general, the water points were spaced so that the maximum travel involved on the part of organizations to the nearest water point would not exceed 1½ miles. Frequently they were spaced more closely.

Likewise, beyond the water point, the responsibility for quality changed. That is, once the water had been taken from the water point, any needed disinfection treatment was incumbent on the Medical Department, through the medical officers attached to the infantry, artillery, etc.

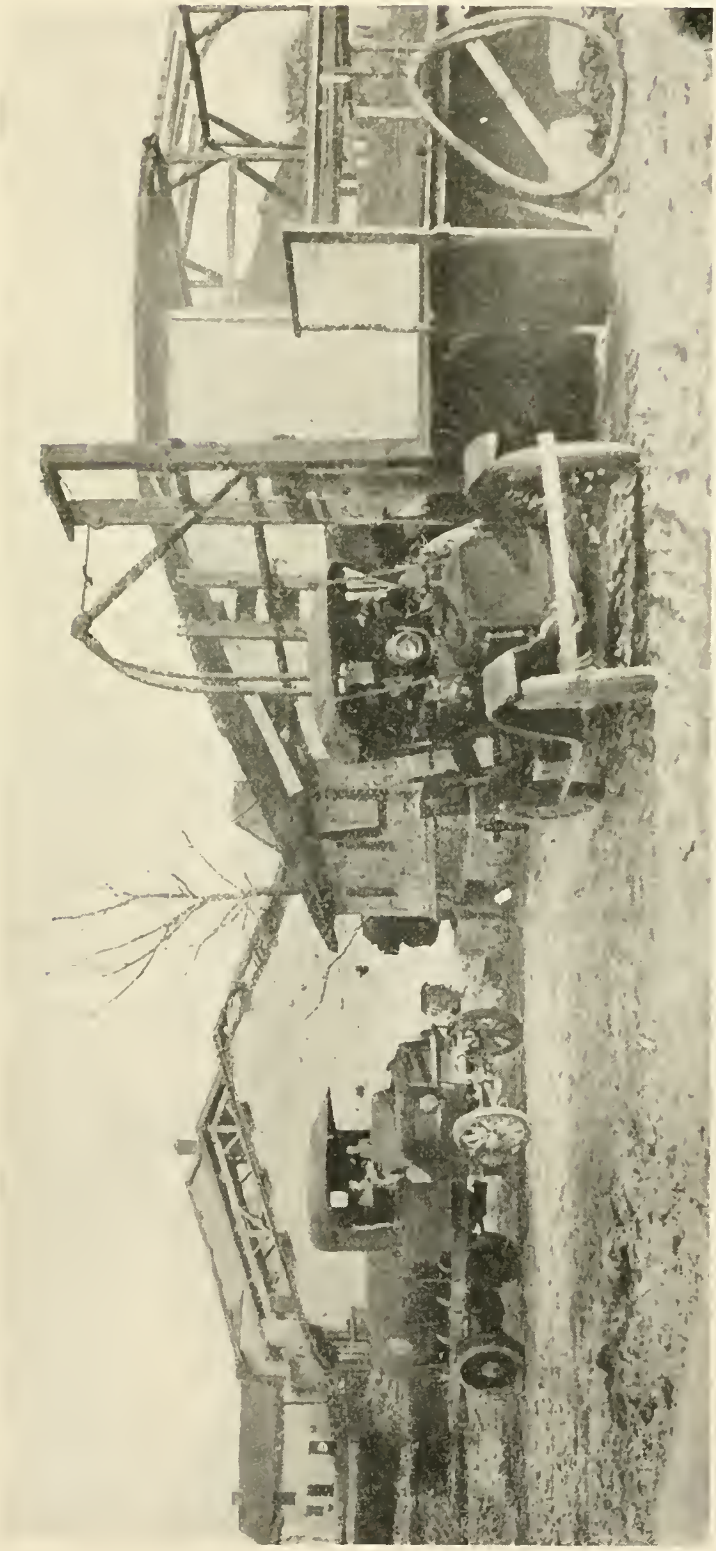
Quite in contrast with the per capita supply of the cantonments in the United States, 55 gallons per man per day, the aim at the front was to provide an average of 2 gallons per man per day. Under conditions of stress, as for instance during the first two days of the St. Mihiel attack, the best that could be offered in certain areas was a little less than 1 gallon per man per day. Animals needed from 8 to 10 gallons per day. Fortunately, in few cases did the animals compete with the troops for water supplies. As far as possible animals were watered from streams and lakes.

The water problems of the St. Mihiel operation exceeded in difficulty those of the Argonne-Meuse operation. Regarding the former, Brigadier General Morrow, as Chief Engineer, First Army, made the statement that of the engineering problems, those of communications and water supply were of primary and parallel importance. The area, as has been stated, is poorly watered, especially during the dry season of the year in which the operation took place. The first consideration of the Water Supply Service was, therefore, to obtain really wet water, and the second, to make that water as pure as practicable.

In the Argonne-Meuse operation, on the other hand, the local water supplies were greater in number and quantity. There the difficulties lay rather in the necessity for speed in preparing for the initial concentration and in meeting the kaleidoscopic changes resulting from tactical successes.

The functions of the water supply troops included the location and development of sources of supply, such as springs, streams, lakes, dug wells, and bore-holes; the construction of the necessary pumping stations, pipe lines, reservoirs, and water point facilities; the operation of water points, including pumping stations; and the quality control of water. In the operation of pumping stations, the assistance of electrical-mechanical troops was had in the early stages of the campaign, but the tendency later on was to make the Water Supply Service more and more self-dependent along this as well as other lines.

The organization of the Water Supply Service of the First Army, for the purpose of carrying out the above functions, is shown in figure 1. The headquarters of the service were framed around the regimental headquarters of the 26th Engineers and generally were located at First Army Headquarters, along with those of the Chief Engineer, Army. The headquarters included the heads of all departments, excepting only the Sector Water Supply Officers who were in direct field charge. Of purely administrative nature were the positions of Office Manager, Adjutant and Personnel Officer. Among the administrative functions of headquarters was that of maintaining liaison, not merely with the other services and branches of the American First Army, but also with the French Eighth Army on the right and the French Second Army, originally on the left of the American First Army and subsequently, in the Argonne-Meuse operation, entirely displaced by the American First Army.



Motor Tank Trucks at Ivoiry (Argonne Meuse)
A captured German concrete reservoir of 17,000 gallons capacity was utilized here

The Reconnaissance or Water Intelligence Department was important in spite of the fact that it was not large. It was most ably headed by Captain Charles H. Lee, 26th Engineers, a member of this Association. It had to do with the obtaining, and making known to proper quarters, of information regarding water supply and water points within our own lines, and also the water supply to be expected or probably most practicable of development once the confronting enemy territory should be taken. Hydrological and geological features received study. The results of the Water Intelligence work were expressed in bulletins and maps. In the latter, especially, some records of high speed production were attained. Thus it became possible to compile during an evening all the information available up to that time: the necessary tracing, lithographing and printing were done during the night; and the maps were ready for distribution early on the following day. This included a 120 kilometer round trip by motor cycle to the lithographing plant.

The Construction Department was naturally of exceeding importance. The Sector Water Supply Officers were in charge of all water supply activities within their sectors, but most of their effort, and that of the troops under them, was devoted to construction. The territorial Districts, as indicated in Figure I, were generally in charge of the commanding officer of one of the companies of the 26th Engineers, who had under him his own company plus a company of Pioneer Infantry. Aside from the 26th Engineers the troops which contributed largely to the water supply construction work, under the First Army Water Supply Service, were the 37th Engineers, the 27th Engineers, and 59th Pioneer Infantry.

But construction work could not be carried on without materiel and here frequently was the rub. A supply officer of the Service was overheard to say: "The only things which the Water Supply Service lacks are personnel, materiel, and transportation." The remark was entirely pardonable, for the difficulties were tremendous. The regimental equipment, specified and shipped with great care from the United States, never reached the regiment. It was only the invoices that came to the regiment in France. In spite of the difficulties, however, the water supply "parks" and "dumps," the larger and smaller depots of materiel, were gradually stocked up by the Supply Department of the Service and it became possible to operate at reasonable efficiency. Much materiel was obtained from French sources.

Under the circumstances standardization was necessarily an ideal rather than a reality. The array of pumps was indeed a motley one. The following figures will give an idea of the quantities involved:

For the two larger operations for the First Army, the Water Supply Service received a total of 300 gasoline engine operated pumps and 400

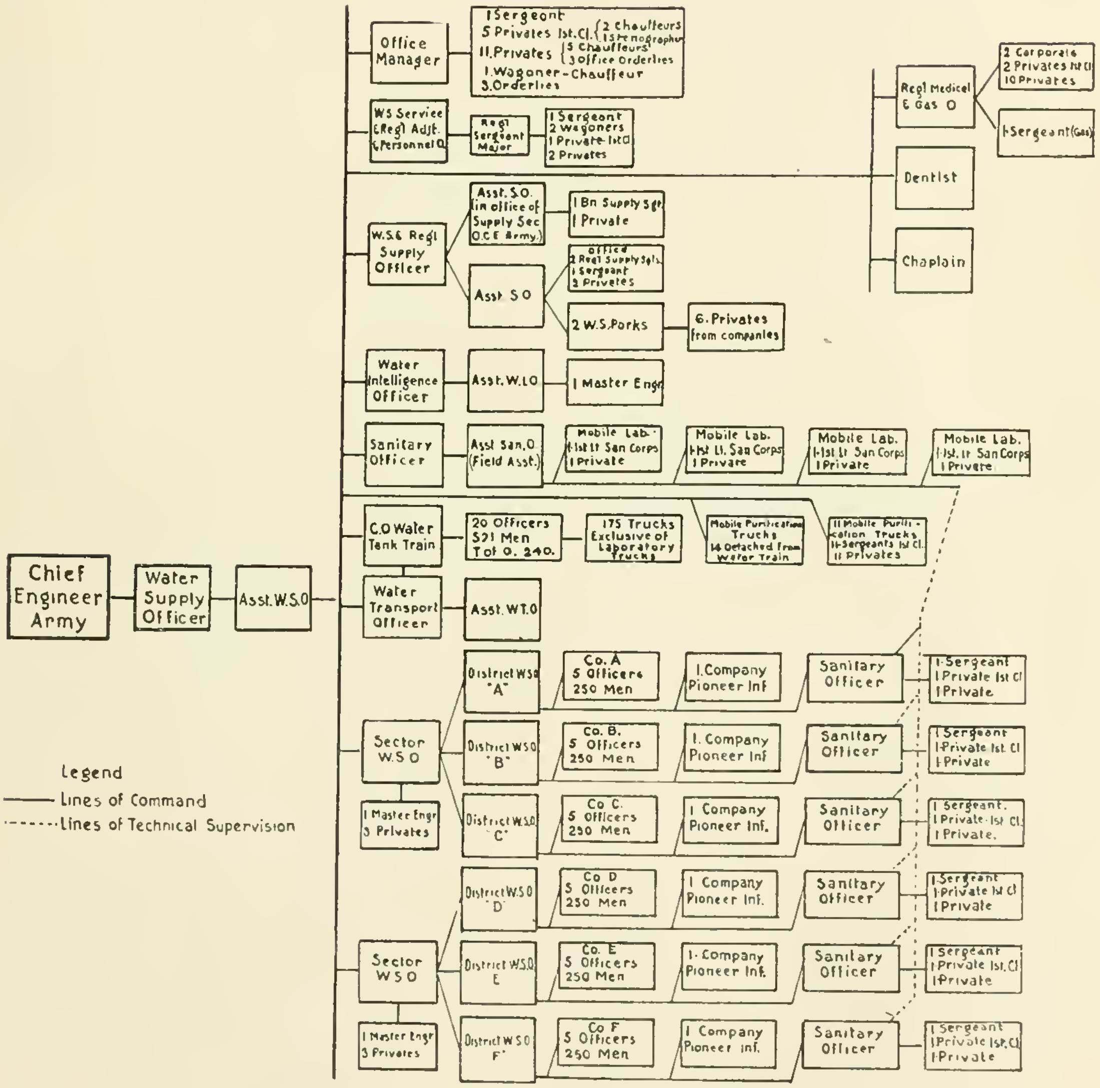


FIG. 1. ORGANIZATION CHART OF THE WATER SUPPLY SERVICE OF AN ARMY, A. E. F.

hand pumps. During the months of September and October, 1918, the following quantities of pipe were received from the rear: 1-inch, 82,000 feet; 2-inch, 86,500 feet; 4-inch, 146,000 feet. In the interest of simplification the above three mentioned sizes of pipe were made standard for army use. For the same reason crosses were eliminated from the fittings and also reducers. The latter fact made it proper to say:

The reducer is dead,
Long live the bushing.

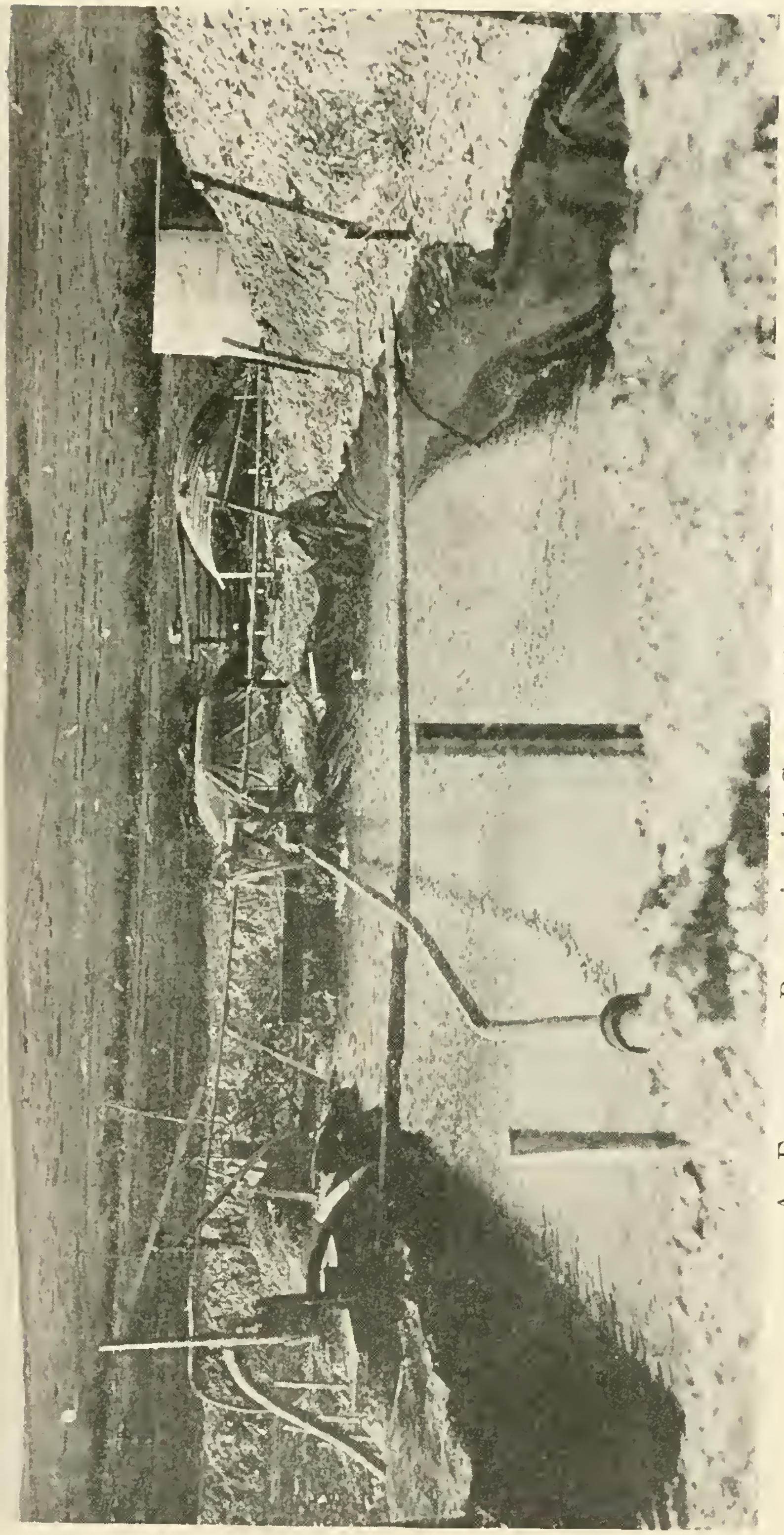
Where water was lacking locally it was necessary to set up artificial water points. These were supplied by transporting water from other sources of supply. Hence there resulted the Department of Transportation of Water.

At the time of the St. Mihiel operation, for which the need for transportation of water was greatest, the authorized Water Tank Trains (Motor) had not arrived from the States. It, therefore, became necessary to organize Provisional Water Tank Trains, totaling about 80 trucks and 260 men. Among the latter was a motor truck company detailed from the 23d Engineers (the road regiment). In the case of the First Provisional Water Tank Train, cargo trucks were equipped for water carrying by means of closed galvanized iron tanks of about 500 gallons capacity, French wine casks, etc. Its total capacity was about 39,000 gallons. The Second Provisional Water Tank Train was made up by converting, to water hauling use, 34 three-compartment, 750-gallon, gasoline carrying trucks. The latter proved to be even better for the purpose than did the specially designed water tank trucks which arrived later on.

After the beginning of the Argonne-Meuse campaign the 301st and 302d Water Tank Trains (Motor) reached France with part of their equipment and in due course the former came to the First Army front. Its personnel of about 500 was utilized largely in manning the trucks of the Provisional Water Tank Trains.

In addition to transportation by motor tank trucks, water was transported by light railway tank cars. Of these approximately 50 were put into use within the First Army area. The cars were entirely of steel and of 2,000-gallon capacity. They were handled by the Light Railway Service under the direction of the Water Supply Service and proved to be a most useful asset in conveying water not merely for men but also for animals. Especially useful were they in reaching artillery positions in wooded areas into which there penetrated no good highways.

The Department last to be mentioned, but by no means least important, is that of Quality Control, having in charge the quality phases of water supply. Its personnel was drawn from both the Engineer Depart-



An Emergency Reservoir with Canvas Lining near Montfaucon

This reservoir held 7500 gallons and was filled from a spring by gravity. Many basins of this type were supplied by means of water tank trains (motor) ment and the Sanitary Corps of the Medical Department. The greater number of the officers concerned were sanitary or public health engineers. A number of them, including Captain H. P. Letton, in charge of the quality control work for the First Army during the latter part of the campaign, are members of this Association.

It was the policy to assume that all water found in the field was bad unless proven to be otherwise. Emphasis was, therefore, laid upon the laboratories and upon disinfection. For the former work there were available both mobile field laboratories, arranged on motor trucks, and also portable laboratories. The apparatus and chemicals of the latter were arranged in chests.

In addition to the above mentioned laboratory equipment for bacteriological analyses and for those chemical tests necessary in connection with chlorination. there were available toxicological outfits provided by the Medical Department for use in connection with possibly poisoned waters which might be encountered. It must be said, however, that neither the British, the French, nor our own Army encountered any water which had been poisoned with any intent to deceive, though of course there were many cases of intentional pollution.

Chlorine gas and hypochlorite of lime were the elements upon which principal reliance was placed for disinfection. In addition a certain amount of javellization was done. This is a process, in common use in the French Army and named after its French originator, consisting in the application of a solution of sodium hypochlorite, usually by hand dosing.

The most universally useful piece of equipment was the water purification truck manufactured for the U. S. Army by the Wallace & Tiernan Company. There were two types of these. The less useful one is known by the trade name of "Chloropump" and contains a pump with an automatic, solution feed, chlorinator. The more useful type,[2] known by the trade name of "Sterilab," includes the pump and chlorinator of the former and in addition a Roberts pressure filter, with alum pot, etc. In addition both types of water purification trucks were equipped with complete laboratory apparatus for bacteriological and chemical work.

Starting on August 17, in preparation for the pending St. Mihiel offensive, with one officer at Army Headquarters and one-half company of troops in the area of the proposed operation, the First Army Water Supply Service reached a total of 1800 men, including 54 officers, for the purpose of that operation. Later the personnel increased to a maximum of 3400 men, including 115 officers. Its personnel was somewhat decreased when the American Second Army was organized and took

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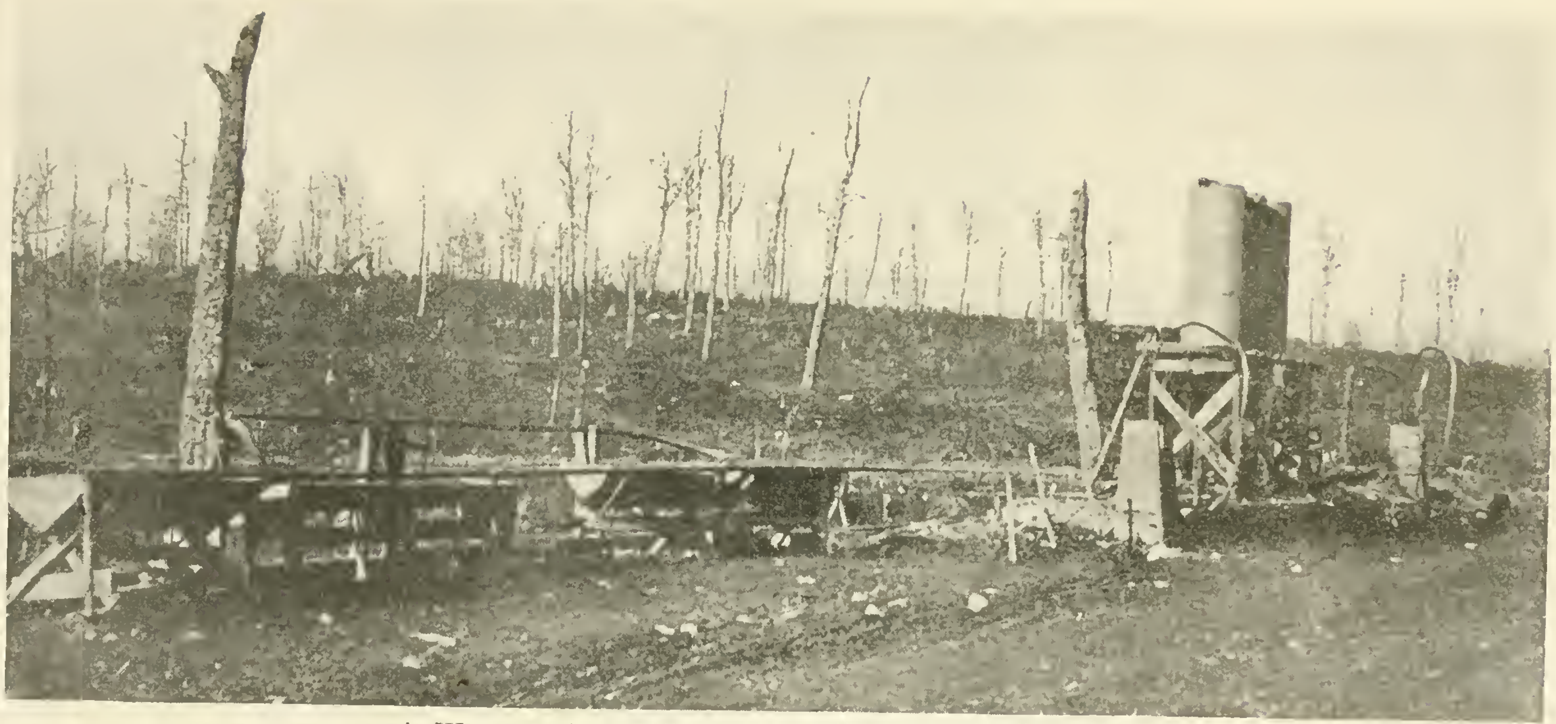
[2] See JOURNAL, September, 1919, p. 562.



A Water Point Along the Montfaucon-Avocourt Road
Here there was limited storage, with facilities for filling water carts and watering animals

over the area over which the St. Mihiel operation had taken place, whereas the First Army continued pressing the Argonne-Meuse offensive.

Closely allied with the work of the Water Supply Service was that of the Divisional Sanitary Inspectors of Water, of whom there was one with each division. These officers were sanitary engineers, including for instance 1st Lieutenant P. O. Collins with the 26th Division and Captain L. A. Fritze with the 42d Division, both members of this Association.

Here and there a piece of more ambitious work was carried on. Thus in the last two weeks preceding the St. Mihiel drive there was conceived and constructed in the Foret de Puvennelle a system for supplying water to men and animals secretly concentrated in these large woods, extending well up to the front line. The development included a pumping station constructed in a chamber driven into the rock of a hillside, for protection against enemy shell fire. Two gasoline driven triplex pumps of 60 gallons per minute capacity at 460 feet head were installed, drawing water from a stream at the base of the hillside. A difference in elevation of 300 feet was overcome. The intake arrangement included a coagulation basin and means for automatic chlorination. Approximately six miles of 4-inch and 2-inch pipe lines were installed, together with a number of reservoirs, of which one had a capacity of more than 10,000 gallons, and a system of hydrants for water cart and motor tank train filling, etc. Also horse watering facilities were installed.

The need for speed, however, was even greater in the Argonne-Meuse operation. Thus the Water Supply Officer, First Army, in common with others of the engineer staff of the Army, received the first notice of the operation on September 11, the day before the St. Mihiel attack. So great was the pressure of the St. Mihiel operation that reconnaissance of the Argonne-Meuse territory could not be begun until September 16; yet all arrangements had to be complete, and were completed, for the first Argonne-Meuse attack by dawn of September 26.

For that operation the American First Army made a marvellous record in the way of troop movement. Hundreds of thousands of men were transported from the St. Mihiel area and from the rear into the new area where until several days before the attack there had been practically only French troops in the front lines. This shifting of troops had to be done at night and with a minuimm of available motor transportation. Even in the case of water supply troops, great as was the immediate need in the new area on account of the pending concentration, one of the companies had to spend three nights on the march, passing through bombed territory at that.

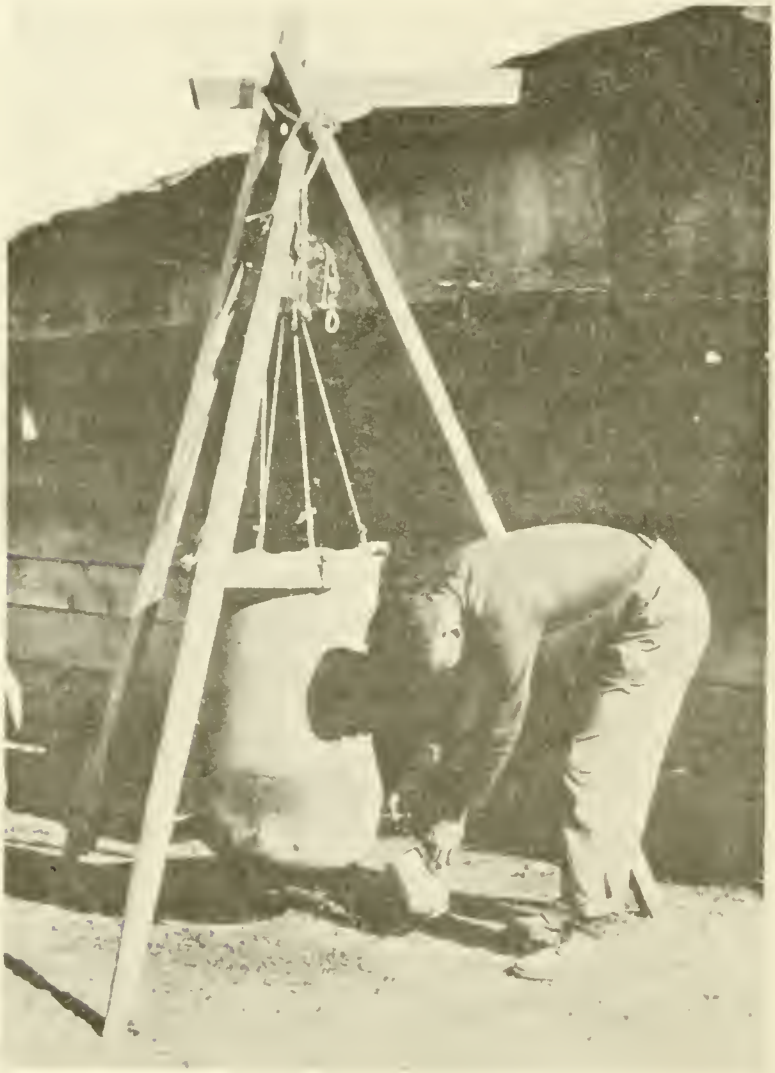
For each "drive" the Army Water Supply Service, like all other branches of the army, had its battle plan. Thus Figure 7 shows the schematic plan for Water Supply in connection with the culminating Argonne-Meuse attack, that of November 1. The "Districts" indicated are those referred to in Figure 1. For convenience the boundaries between Districts were fixed as north and south lines, thus differing considerably from the army corps boundaries. Immediately following the attack on the morning of November 1, "F" District, for instance, sent forward four advance parties which had previously been posted at positions indicated on the plan as 1a, 2a, 3a and 4a, respectively, near the center of the "jumping off" line.

Each of these parties was composed of about 25 men with a mule-drawn wagon-load of materiel for installing emergency water supplies. Advance Party No. 2, for example, was under orders to set up water points as closely as practicable to positions 2b, 2c, 2d, 2e and 2f. The schematic plan also shows the dispositions to be made, immediately prior to the attack, of the resources of the Water Supply Service available for the purpose, as regards both materiel and personnel.

Before leaving the subject the speaker desires to pay tribute to the splendid character of the personnel comprising the rank and file of the Water Supply Service. The 26th Engineers alone included members from all states of the Union except two, and, besides, members from Alaska and the Canal Zone. In general the men were real "dough-men" rather than "doughboys," men who knew what kind of work they were volunteering for, and who were skilled at that work. Especially versatile were the oil field workers from Texas and California.

Though not normally engaged in front line work, yet their positions subjected them to continual danger and at times their work carried them even into No-man's Land. Like other army troops, they were subjected to hazard without the opportunity to fight back. The greater part of the army water supply work was carried on in the area just ahead of the heavy artillery and just back of the light artillery —an area exposed to frequent enemy shell fire. Even those engaged in the work of quality control were subjected to the hazard. Thus First Lieutenant Joseph Tinsman, Sanitary Corps, Company F, 26th Engineers, was severely wounded on November 4 and gamely fought death until he was forced to succumb November 17, the very day when the American Army of Occupation, including Companies C and F, 26th Engineers, started its march toward the Rhine.

Aside from the above mentioned difficuties there were the hardships due to poor shelter, scarcity of blankets and difficulties in obtaining rations for troops so widely scattered. Infantry divisions would go into the line for days or weeks according to the severity of fighting and then come out and go to the rear for rest. But the First Army troops received no relief whatsoever during the entire campaign. Some of the Water Supply troops were at work on active fronts beginning in the Chateau-Thierry region in August and continuing to the very day of the armistice. The Water Supply troops performed a task which was not easy and, judging by the lack of complaint, performed it well.



The Lyster Bag
Much of the water "wholesaled" by the Water Supply
Service was "retailed" through such bags

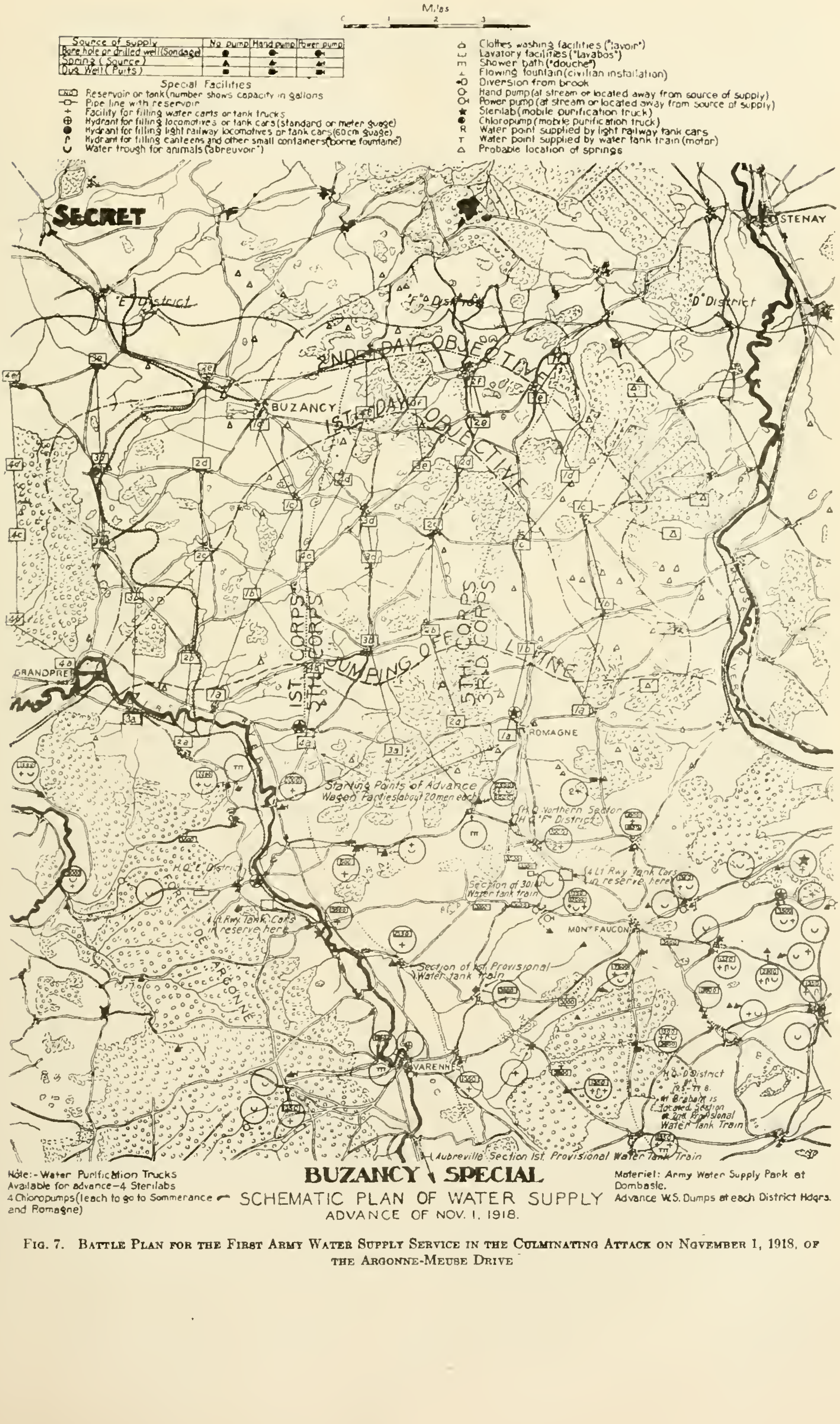

Miles
0 1 2 3
Source of supply | No pump | Hand pump | Power pump
Bore hole or drilled well (Sondage)
Spring (Source)
Dug Well (Puits)
Special Facilities
Reservoir or tank (number shows capacity in gallons
Pipe line with reservoir
Facility for filling water carts or tank trucks
Hydrant for filling locomotives or tank cars (standard or meter guage)
Hydrant for filling light railway locomotives or tank cars (60 cm guage)
Hydrant for filling canteens and other small containers (borne fountaine)
Water trough for animals ("abreuvoir")
Clothes washing facilities ("lavoir")
Lavatory facilities ("lavabos")
Shower bath ("douche")
Flowing fountain (civilian installation)
Diversion from brook
Hand pump (at stream or located away from source of supply)
Power pump (at stream or located away from source of supply)
Sterilab (mobile purification truck)
Chloropump (mobile purification truck)
Water point supplied by light railway tank cars
Water point supplied by water tank train (motor)
Probable location of springs
SECRET
STENAY
"E" District
"F" District
"D" District
2ND DAY OBJECTIVE
1ST DAY OBJECTIVE
BUZANCY
GRANDPRE
ROMAGNE
IST CORPS
3TH CORPS
5TH CORPS
3RD CORPS
JUMPING OFF LINE
Starting Points of Advance Wagon Parties (about 20 men each)
H.Q. Northern Sector H.Q. "F" District
4 Lt Rwy Tank Cars in reserve here
Section of 30 Lt. Water tank train
H.Q. "E" District
4 Lt Rwy Tank Cars in reserve here
ARGONNE
MONTFAUCON
Section of 1st Provisional Water tank train
VARENNES
H.Q. "D" District
Aubreville Section 1st Provisional Water Tank Train
Note:- Water Purification Trucks Available for advance—4 Sterilabs 4 Chloropumps (1 each to go to Sommerance and Romagne)
BUZANCY SPECIAL
SCHEMATIC PLAN OF WATER SUPPLY
ADVANCE OF NOV. 1, 1918.
Materiel: Army Water Supply Park at Dombasle.
Advance W.S. Dumps at each District Hdqrs.

Fig. 7. Battle Plan for the First Army Water Supply Service in the Culminating Attack on November 1, 1918, of the Argonne-Meuse Drive

TESTS ON 63-INCH CORE JOINT REINFORCED CONCRETE PIPE

By Robert L. Fox, '09, City Engineer, Bethlehem, Pa.

At Johnstown, Pa., during the summer of 1917, there were performed load deflection tests upon 63 inch Reinforced Concrete Pipe. Primarily, the tests were made to determine whether the pipe then being manufactured for an outfall sewer fulfilled the requirements of the specifications, which were based upon a few tests upon smaller pipe made elsewhere, and stated in substance that the pipe when under a concentrated load of 2100 pounds per lineal foot, applied along an element at the top and without lateral support, should not develop flaws detrimental to its use. Careful observation of the materials used and the method of manufacture indicated that the pipe was first-class and as good as could be expected. Also, in performing these experiments, the thought was to derive a specification for future work which would result in securing pipe equal in quality to that then being manufactured.

The testing machine constructed for this purpose was not an original design, it being similar to machines used elsewhere for such purposes. To ascertain the deformations, two Ames Dials reading to .001 of an inch fitted with extension rods resting on the invert of the pipe were placed at each end of the pipe. As shown in the drawing the pipe rested on two one-inch half-round supports, spaced 4½ inches center to center. The load was applied through a lever system to an oak bearing block six inches in width, extending the full length of the pipe. The initial load upon the pipe from the lever system was computed to be 872 pounds. With the initial load in action, the Ames Dials were set to zero and a load of 92 pounds was slowly placed upon the loading platform. This load multiplied through the lever system, plus the initial load, amounted to an applied load of 2408 pounds upon the pipe. Both dials were then read and the average of the two was taken as the deflection of the pipe. The load was then removed to determine the permanent set. The process was repeated, with increased increments of load, until the yield point was reached as indicated by the "drop of the beam." (In this case by the run of the dials). At this point the dials were read at the beginning and end of the yield. This process was continued until a total load of 8387 pounds or 2097 pounds per lineal foot was applied to the pipe. After each increment of load had been applied the pipe was examined for hair line cracks, the position and extent in each case being recorded.

The pipe was the standard core-joint pipe with six inch walls reinforced with two layers of American Steel & Wire Company's triangle mesh, Style No. 146, 48 inches wide with a total weight of 1.3 pounds per square foot. The age of the pipe tested was from 26 to 33 days. None of the pipe tested showed any appreciable failure, although all, with the exception of nine tests, developed hair line cracks at the top and bottom, extending in one case the full length of the pipe.

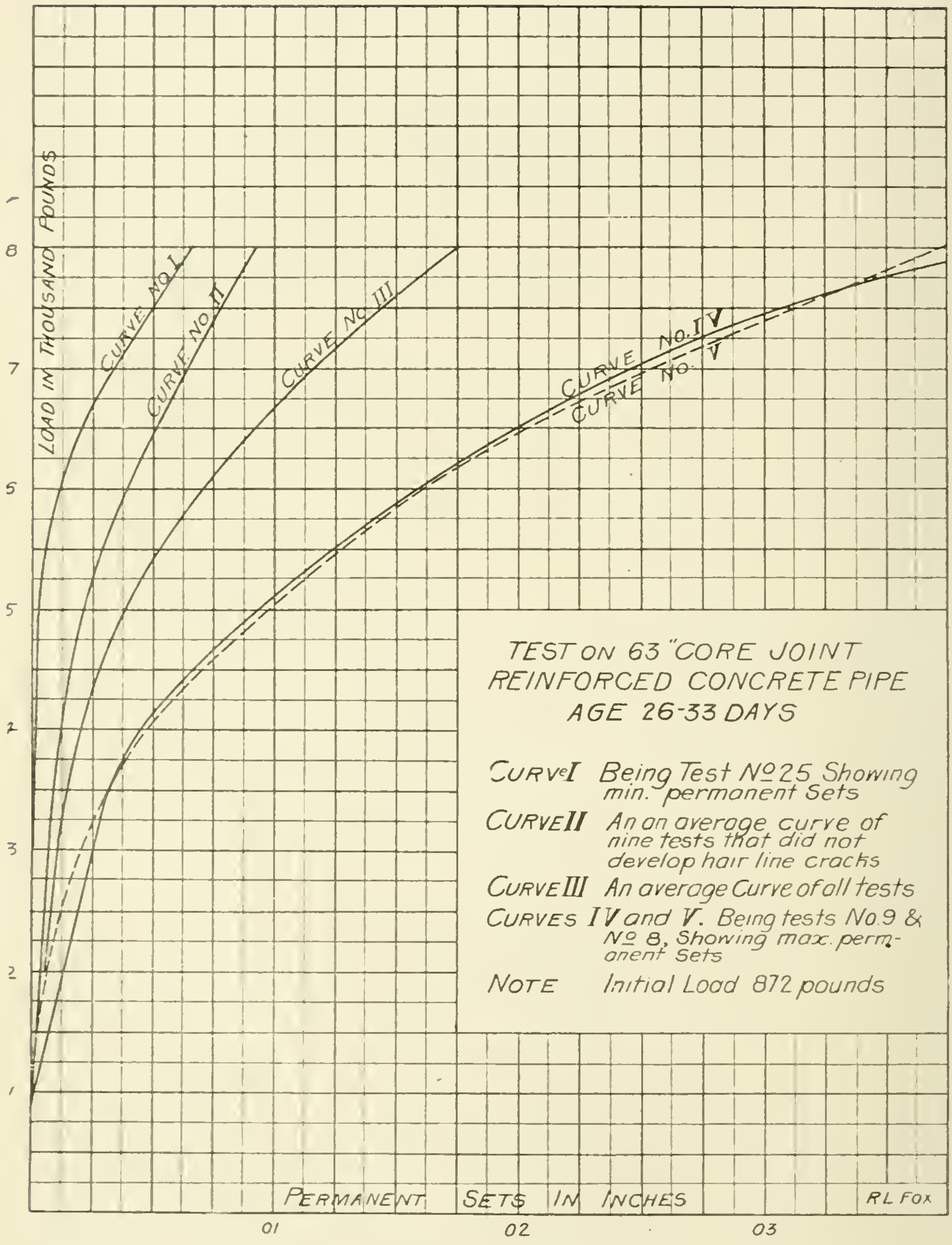
Compression tests of concrete cylinders to ascertain the modulus of elasticity were not performed, due to the lack of testing apparatus for this purpose. It is unfortunate that municipalities are not in a position to supply their engineering departments with proper testing equipment.

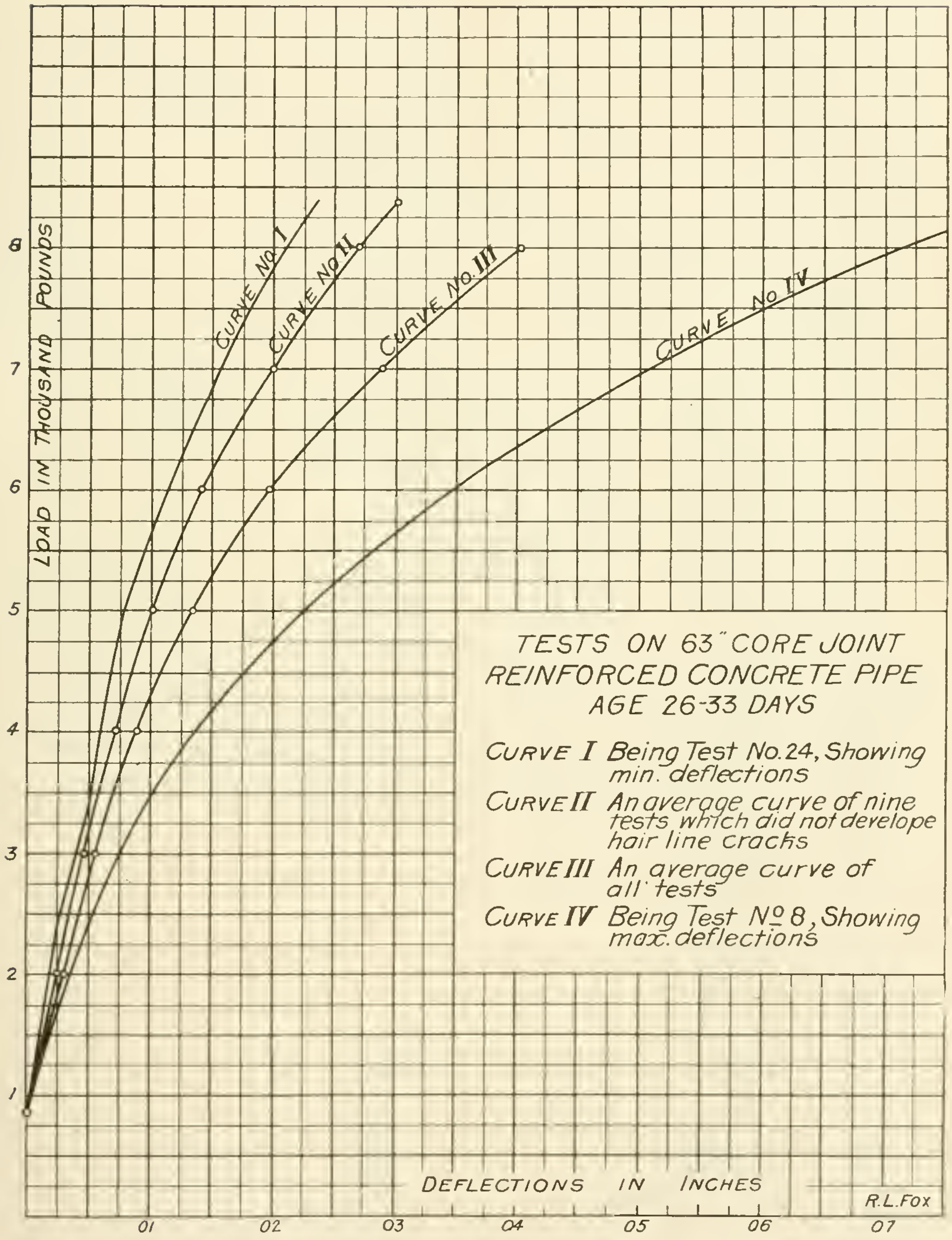
It is to be admitted that the condition of the test did not represent the true considerations of a pipe under load in a trench. The stresses developed when a pipe is in place are dependent upon the bending moment, which is difficult to ascertain, as the distribution of the load depends upon the way the pipe is bedded, the care exercised in tamping of the earth around the sides, the action of the earth on top, the amount of lateral pressure of the earth horizontally and the moisture content of the surrounding soil.

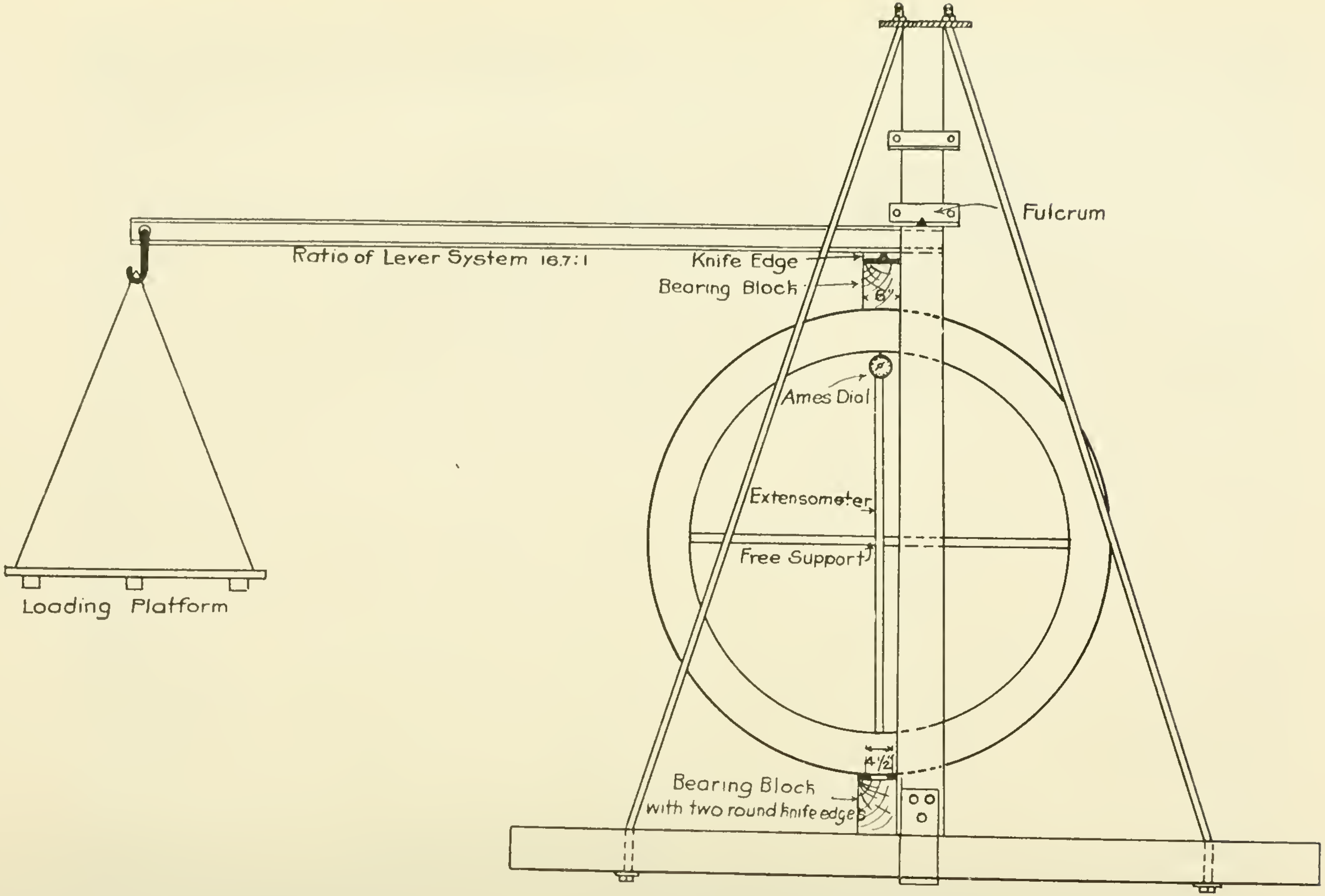
The yield point, as indicated by the dials, occurred from loads varying from 4913 to 8387 pounds. As was to be expected, the yield point occurred at about the same time that hair line cracks were observed. The "relative elastic limit" as determined by Professor Johnston's method, applied to the average curve of all tests, indicates it to occur under a load of 4000 pounds.

IMPACT TESTS UNDER TRENCH CONDITIONS

In addition to the tests performed above, it was decided to determine the effect of a falling load upon pipe in place. In backfilling with conveying machines, it is good practice to require the lowering of the conveying bucket to within a few feet of the top of the pipe before the contents are emptied onto the pipe. On this work, a Moore conveying machine with buckets of two-thirds yard capacity was being operated in a rock cut. The pipe was laid on a plank twelve inches in width. The backfilling around, in under, and on top of the pipe, was of selected earth well tamped. A pipe was selected sixteen feet from the end of pipe lying where the backfilling of earth had been carried 2½ inches above the top of the pipe. Two Ames Dials with the extensometers were placed vertically at each end of the pipe on the inside so as to indicate the vertical deflection resulting from a sudden impact on top of the pipe. The bucket of the conveying machine full of loose rock


LOAD IN THOUSAND POUNDS
1
2
3
4
5
6
7
8
CURVE NO. I
CURVE NO. II
CURVE NO. III
CURVE NO. IV
CURVE NO. V
PERMANENT SETS IN INCHES
RL FOX
.01
.02
.03
TEST ON 63" CORE JOINT REINFORCED CONCRETE PIPE AGE 26-33 DAYS
CURVE I Being Test Nº 25 Showing min. permanent Sets
CURVE II An average curve of nine tests that did not develop hair line cracks
CURVE III An average Curve of all tests
CURVES IV and V. Being tests No. 9 & Nº 8, Showing max. permanent Sets
NOTE Initial Load 872 pounds


TESTS ON 63" CORE JOINT
REINFORCED CONCRETE PIPE
AGE 26-33 DAYS
CURVE I Being Test No. 24, Showing min. deflections
CURVE II An average curve of nine tests which did not develope hair line cracks
CURVE III An average curve of all tests
CURVE IV Being Test No 8, Showing max. deflections
CURVE No. I
CURVE No. II
CURVE No. III
CURVE No. IV
LOAD IN THOUSAND POUNDS
1
2
3
4
5
6
7
8
DEFLECTIONS IN INCHES
.01
.02
.03
.04
.05
.06
.07
R.L.Fox



ELEVATION OF TESTING MACHINE

weighing about 1500 pounds was emptied from a height of 20 feet above the pipe and the jump of the Ames Dials was observed. The second set of tests was performed under like conditions with the exception that the depth of the earth fill was 36 inches above the top of the pipe.

FIRST SERIES

Age of pipe—43 days
Depth of fill—2½ inches

	Deflections		Average Deflection
	E	W	
1st bucket	.0015	.0015	.0015
2d bucket	.0005	.0015	.0010
3d bucket	.0015	.0015	.0015

SECOND SERIES

Age of pipe—38 days
Depth of fill—36 inches

	Deflections		Average Deflections
	E	W	
1st bucket	.002	.002	.002
2d bucket	.002	.0015	.0017
3d bucket	.002	.0015	.0017

Using the average curve of all tests which is approximate, on account of the lack of lateral supports, the impact resulting under conditions of the test would have occurred under a concentrated load applied to the pipe in the testing machine of about 1600 pounds.

CONCRETE ROAD CONSTRUCTION IN NEBRASKA

By A. S. Mirick, '01
Chief Construction Engineer, Nebraska Department of Public Works.

Nature has been niggardly to Nebraska in the matter of bestowing materials for hard surfaced roads. The stone supply is confined to the southeastern portion of the State, and consists of limestone deposits of varying hardness. Some samples show a French Coefficient of wear of eight, but the hard stratas are so distributed in the quarries that it is almost impossible to get a uniform product that would be suitable for an aggregate for concrete pavement.

The Platte River runs through the central part of the State, and for ages it has been rolling down the feldspar and quartz rock from the Rockies and depositing the same in Nebraska; so that in many places this material is pumped up, screened, and graded, and makes splendid aggregate for concrete. The material in question, however, violates a favorite condition that Engineers have made a part of their fine aggregate specifications, viz.; that the particles must be sharp. This theory has been proven falacious, for the rounded particles if they are clean and hard, have been found to develop more strength than the sharp variety.

The material pumped up from the Platte River has another characteristic that has caused engineers to be cautious, that is its fineness. One who is familiar with Prof. Abrams' tests, knows that he has developed a theory that if a material shows a certain modulus of fineness, depending upon its grading, this material may be composed of any sized aggregate. Even the grading is relatively unimportant in comparison with water content. With this theory in mind it was decided to send a sample of the Platte River material to the testing laboratory of the Bureau of Roads, Department of Agriculture, Washington, to determine whether so called Platte River gravel would meet with their approval for use on concrete paving work in Nebraska. This matter was an important one as it meant utilizing the greatest supply the State has for paved road. The analysis of the sand-gravel mixture was as follows:

Passing ¾" mesh screen and retained ½" screen	2.0
" ½" screen and retained ¼" screen	12.7
" ¼" screen and retained ⅛" screen	85.5

Retained on ¼" screen	14.7%
Passing ¼" mesh retained on 10 mesh	44.4
Passing 10 " " " 20 "	27.9
Passing 20 " " " 30 "	5.5
Passing 30 " " " 40 "	3.1

Passing 40 mesh retained on 50 mesh	1.3
Passing 50 " " " 80 "	1.9
Passing 80 " " " 100 "	0.2
Passing 100 " " " 200 "	0.5
Passing 200 "	0.5
	100.0
Loss by washing silt and clay	0.4

The sample consisted essentially of rounded fragments of granite, quartz quartzite, with a large amount of subangular quartz sand.

Samples of the material were tested for compression and compared with Potomac River screened gravel. The mixture of the Platte River sand-gravel was one part of cement by volume to three parts of the sand-gravel.

The Potomac River material was used in proportion 1 part of cement, 1½ part of Potomac River sand, and three parts of Potomac River gravel measured by volume. The dividing line between sand and gravel, of course, being ¼″ mesh screen; all that was retained on this screen was considered gravel, and all passing through considered sand.

6″ x 12″ cylinders were prepared of concrete made from both materials and aged 7 days. Two test samples were prepared of each. The total loads sustained by the cylinders of Platte River gravel were 58350 lbs. and 65940 lbs. with an average of 62145 lbs.

The total loads sustained by the cylinders of the Potomac River gravel were 57780 lbs. and 58180 lbs. with an average of 57980 lbs.

The average unit crushing strength of the Platte River sand-gravel concrete was 2198 lb. per sq. in. The average unit crushing strength of the Potomac River gravel concrete was 2050 lb. per sq. in.

As a result of this test it was decided to use this material for paving with concrete a portion of the Lincoln Highway 5.94 miles in length running from Fremont to Ames.

The plans for this stretch of concrete paving called for a pavement 18 feet wide the thickness in the center being 8 inches and the thickness on the sides 6 inches, the pavement being laid in blocks 36 feet long with a ½ inch elastic expansion separating each block.

The Platte River runs parallel to this road and material for the aggregate could be obtained with very easy hauls direct from the plants operating along the river in the immediate vicinity of the road.

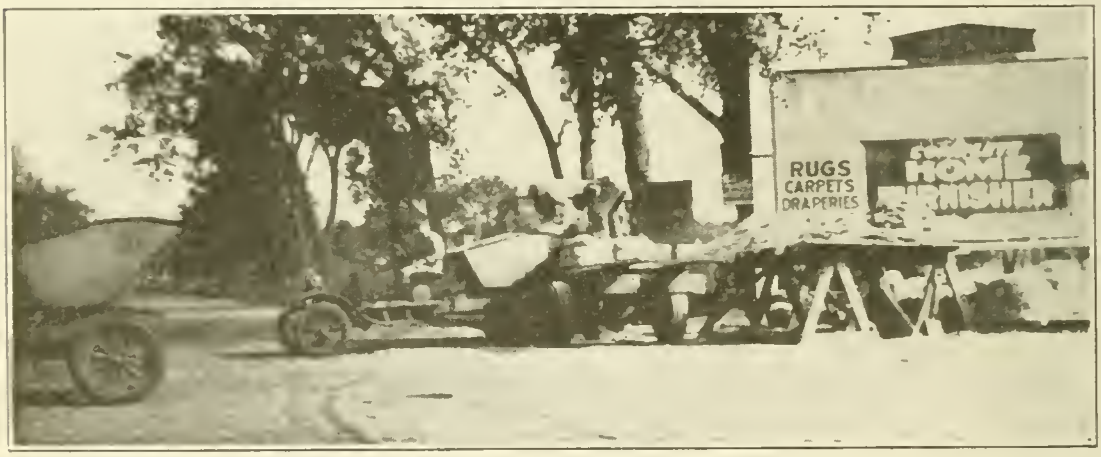
Consequently the contract was let for the construction of the road at a cost of $199,440.34. The features of this road that made its construction different from the ordinary construction of concrete roads are:

1. The use of aggregates of this character is such a radical departure from the accepted practice as to excite considerable interest.

2. The construction methods, while not original are novel, owing to the fact that labor has been reduced to a minimum by the installation of the most modern machinery.

The subject of aggregates has been quite fully discussed, and I need only add that the gravel is dredged from the shores of the Platte River. The effluent from the pump carries the sand and gravel to a series of sorting screens and chutes, where the fine and waste materials are returned to the lake pit.

The material to be used is delivered into the bins ready for truck loading. The material is then hauled to piles located at convenient places along the road for storage. The hauling from the bins to the stock pile is done by trucks.

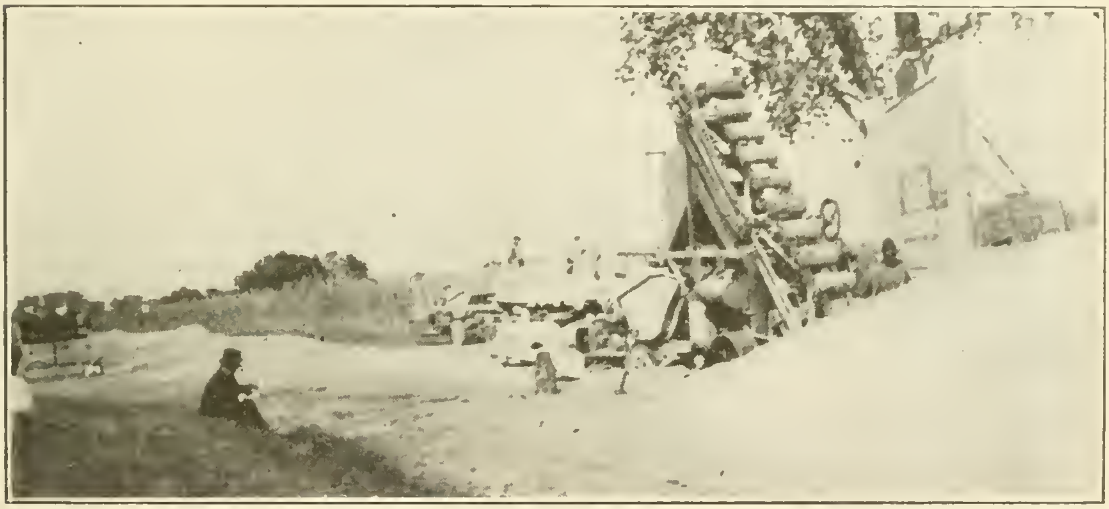


Receiving the cement. Each truck load of material represents a batch of concrete.

Loading Ford trucks with sand-gravel. No horses were used on this job.

EQUIPMENT

Near these stock piles a platform for storing cement bags has been erected, and all of the charges for the mixer are carried from the stock piles by means of Ford trucks. These Ford trucks are equipped with Lee dump bodies holding 21 cu. ft. of sand gravel mixture. The sand-gravel mixture is loaded on the trucks by means of an automatic loader. This charge is rushed to the mixer, dumped, and the truck returns at a 50 mile an hour gait for another load. The advantages of this manner of handling material from the stock piles to the mixer over the old method of hauling by teams are as follows:



Method of handling concrete aggregate. Note bucket loader.

1. The sub-grade is kept in good condition ahead of the concrete by the action of the over-sized tires of the Fords.

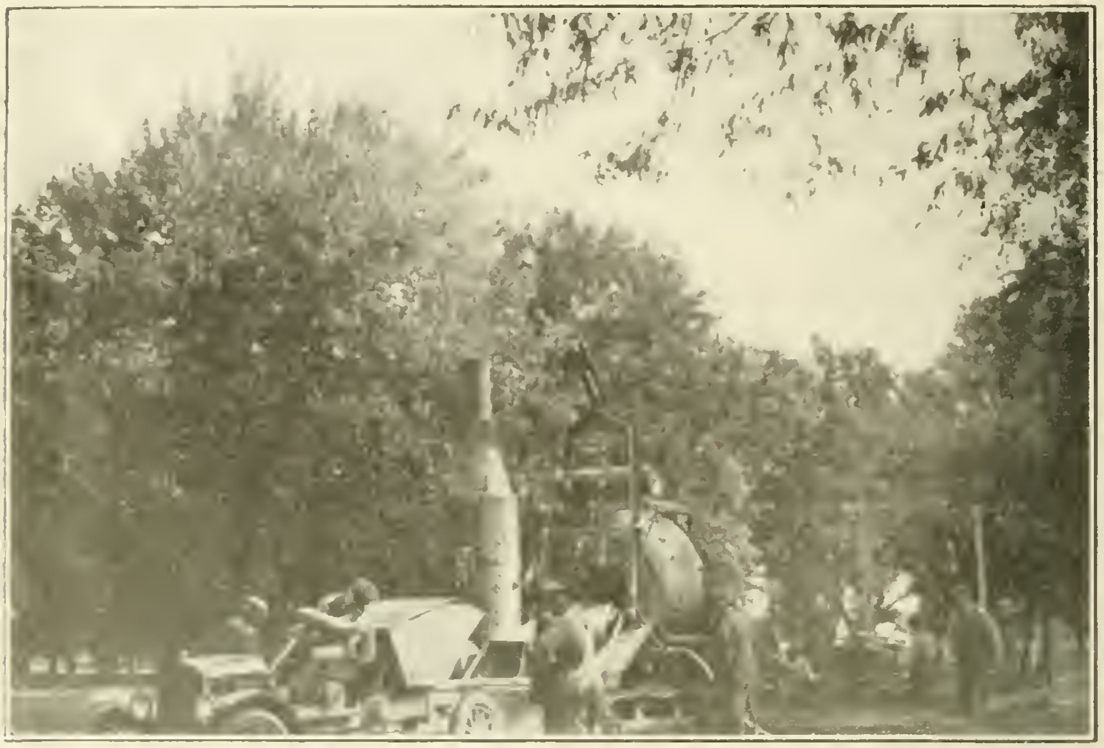
2. The speed of operation of the trucks obviates the confusion and congestion that occur with teams, since many teams must be on the road to handle the same amount of material.

3. It eliminates the old time skinner, who sleepily dozed over a pair of mules, and utilizes the young man whose who has a real interest in motor vehicles, encouraging him to work at something he really likes and helping to solve the labor question.

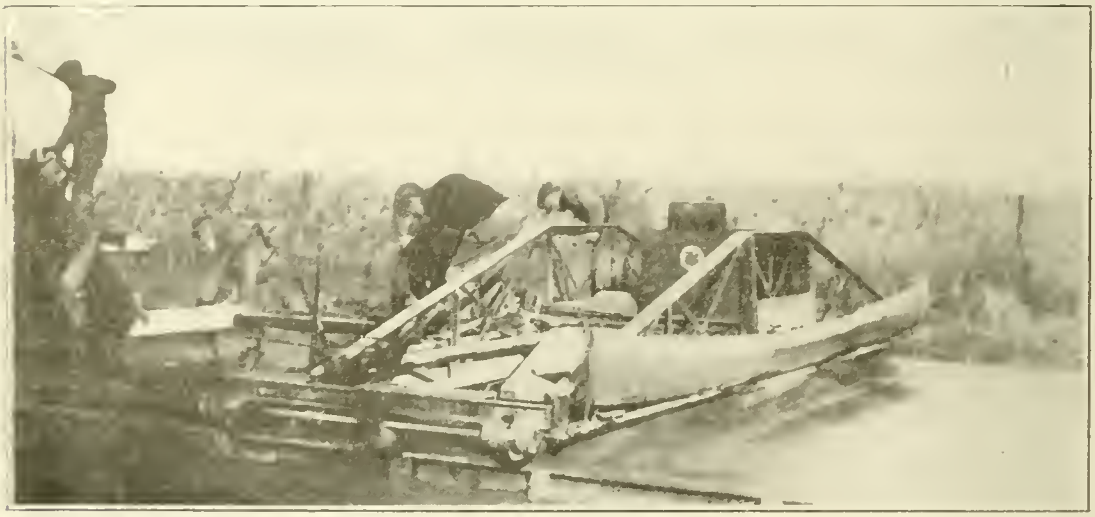
4. Above all it greatly diminishes the number of men required, and entirely eliminates the difficulties of using teams.

The concrete is mixed in a large three-fourths yard Foote concrete mixer. This mixer is equipped with caterpillar tractors that distribute the load of the mixer on the subgrade at a pressure of about 4½ pounds per square inch. The ease with which this machine can be moved forward with little damage to subgrade makes it an ideal machine for concrete paving.

The forms used are Blaw-Knox pressed steel forms that combine the qualities of a form with a track to receive the finishing machine. The finishing machine used is manufactured by the Lakewood Engineering Company, and is both a money saver to the contractor, and a source of joy to the engineer. This machine automatically cuts out the finished section of the road by means of a steel templet attached to the

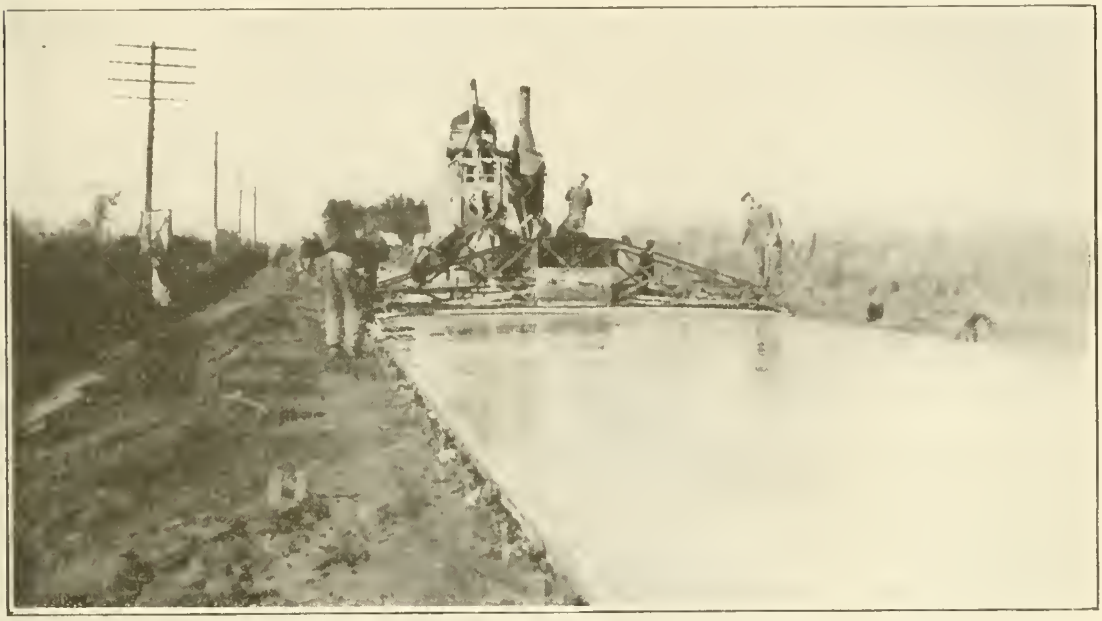


Dumping the batch into the mixer



The finishing machine. Note the forms. They also serve as a track for the finishing machine.

front of the machine. A short distance back of this templet is a curved tamper that tamps the road evenly to the exact finished cross section. Behind the machine is mounted a belt that rapidly passes back and forth across the pavement and puts a finish on the work that cannot be equalled by hand. The whole machine is motor driven, and when once started needs no attention.



The finishing machine in operation. Note the finished pavement in the foreground.

CONSTRUCTION METHODS

The work was started at the end farthest from the source of supply. The sand-gravel mixture and cement was brought to the mixer, dumped, and hoisted into the drum. About 6 per cent of water by volume measured by a gauge attached to the mixer is then run into the drum and the whole thoroughly mixed. The product of the mixture is run into the forms by means of a chute and roughly placed. The consistency of the concrete is such that it will roll down the chute with a little help from the spreader. The finishing machine is started and the section completed immediately. An edge is then run along the form to give the slab a finished appearance. The pavement is laid in sections 36 feet long, each section being separated by an expansion joint ½ inch thick.

CURING

As soon as the concrete is set, if the temperature is high, the pavement is covered by a tarpaulin. This is removed after a short period and a covering of not less than two inches of earth is applied and kept moist for a period of not less than 10 days. The road is closed for traffic for 14 days. The shoulders are then constructed and the entire roadway finished up as the pavement progresses.

TESTING MATERIALS

The cement is tested according to the specifications of the American Society for Testing Materials, a laboratory having been equipped for this purpose in the field.

Sieve analyses are made of the sand-gravel aggregate from time to time. Very close watch is kept on this material to see that it conforms exactly with the specifications. Very little variation of the coarser material is allowed and any deficiency in this respect has to be adjusted.

INSPECTION

This work is supervised by the Department of Public Works of the State of Nebraska aided by the government. The State places a Project Engineer on the work, who is supplied with such assistants as he needs. He is required to lay out the work, secure samples of material, and to be responsible for the inspection of the same. He makes a daily report to the Department of material used and progress made. His work is also subject to inspection from time to time by the officials of the State and Department of Agriculture. He makes all measurements for estimates, and certifies the same.

In conclusion let me add that this work, though it represents a small part of Nebraska's road building program, is being watched by engineers in the middle west with a great deal of interest for on the result of this work may rest the solution of the problem of cheaper pavements for some of the Central-Western States that have no suitable material for coarse and fine aggregate. The successful use of the Platte River deposit will have a great influence in extending hard surface road systems in Nebraska and adjoining regions.

MORE THAN 80 MILES OF CONCRETE ALLEYS IN BALTIMORE*

By George F. Wieghardt, '09
Highways Engineer, Baltimore, Md.

Early in 1916, Baltimore having rapidly reduced the mileage of cobble paved streets for which it had been noted in the paving world, turned its attention toward improving the condition of its alleys, which at that time were paved principally with cobblestones and sidewalk brick. The condition of our alleys was such as to be a continuous meance to the public health, it being practically impossible to keep their roughly paved surfaces clean.

Prior to 1916, our Paving Commission had improved a number of alleys in the central portion of the city with modern paving material, including among other types 9,850 square yards of concrete laid in 1914, and 8,455 square yards laid in 1915. The first alleys built of concrete had tar tops but this practice was soon discontinued.

In 1916 the Highways Engineer, in whose charge practically all alley construction was placed, decided to use Portland cement concrete for improving alleys—first, because the character of the surface was such that it could be kept clean at little expense; second, first cost was reasonable; third, maintenance was low; and fourth, a saving could be effected on grading, because any other type of pavement would require concrete foundation, which would mean an additional six inches of excavation on every alley—the permanent grades having long been established.

From 1916 up to September 1, 1919, concrete alley pavement was laid as follows:

1916— 335 alleys– 61,968 sq. yd.–10.5 miles
1917—1124 " –236,153 sq. yd.–40.3 "
1918— 267 " – 88,000 sq. yd.–15 "
1919— 460 " – 94,980 sq. yd.–16 "

In addition to the above there have been paved during the same period about 850 small alleys ranging in width from 2 to 7 feet.

Our alley specifications call for a uniform section of 6 inches of plain concrete mixed in the proportions of 1 part Portland cement, 2 parts sand and 4 parts broken stone. The stone is a hard trap, gneiss or granite, free from dust and of a size that will pass through a 1¼-inch ring and be retained on a ¼-inch screen. Finish is obtained by means of a template and wooden hand floats. Concrete is sprinkled with water as soon after finishing as can be done without pitting the surface, and kept moist for

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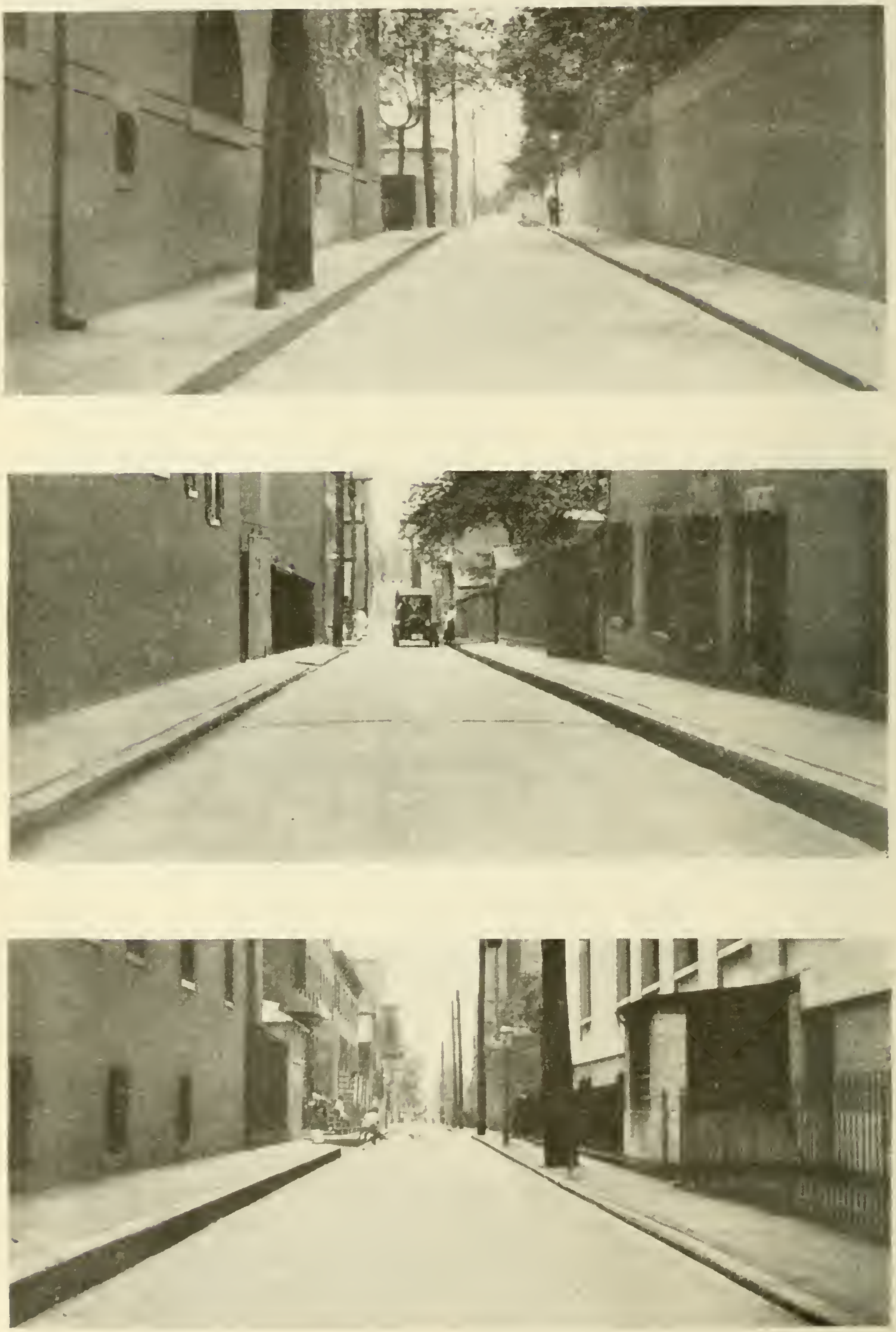
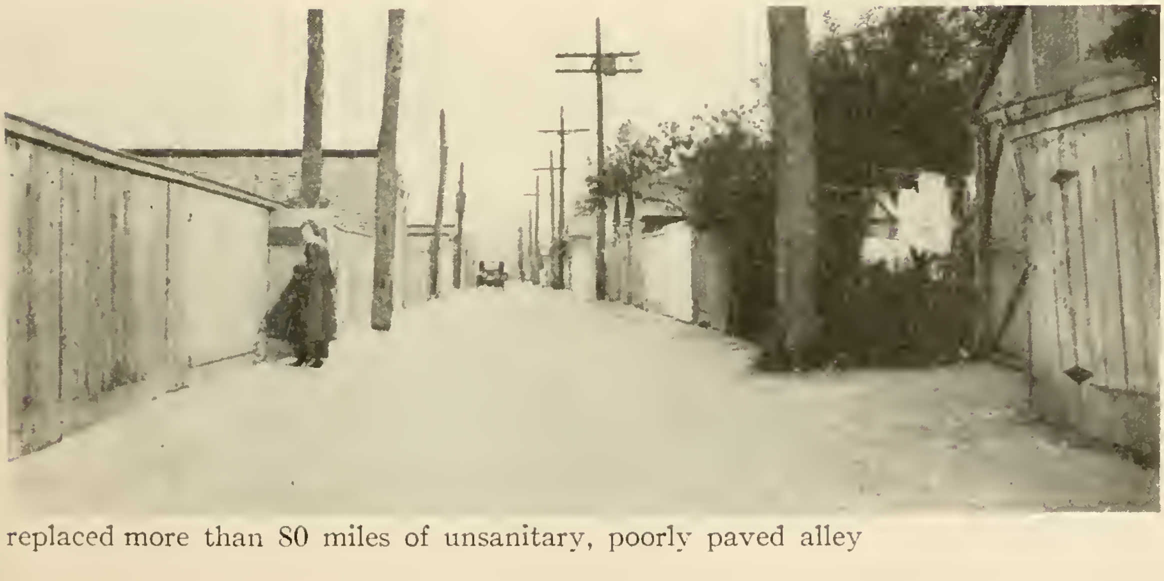
*From Concrete Highway Magazine



These are a few of the clean, concrete paved alleys in Baltimore which have



replaced more than 80 miles of unsanitary, poorly paved alley seven days, during which time it is protected by canvas covering, sand or earth. Alleys are kept closed to traffic until fourteen days after the last concrete has been laid. Preformed joints ¼-inch wide are used every 50 feet. The form of section used has depended upon local conditions. Where curbs could be used, the section was convex or crowned, a fall of 6 inches, from the center line to the curb being used; where local conditions made it impracticable to use curbs, a concave or dished section was used, the gutter line being the center of the alley.

The alleys were advertised, and awarded in groups of from thirty to forty to a single contract. The cost of each alley is assessed against the abutting property.

Alleys are guaranteed by the contractors for a period of five years. Up to the present time maintenance has been very small. On most alleys there has been none at all.

The success of concrete alleys in Baltimore may best be shown by the fact that there are at present over 600,000 square yards of them in the city and that the officials in charge of paving are planning to increase this yardage as rapidly as possible.

TAKING THE QUESTION OUT OF THE GOOD ROADS QUESTION

By M. S. Darrow, '99

For years, discussion has been rife regarding the question of what constitutes a good road.

The layman has been harangued on all sides with advertisements, circulars, literature of all descriptions, praising to the skies one material or another as the sure panacea for road ills.

Although the writer does not intend to discourage limited experiments with various materials to test their adaptability for road purposes, still it has always been to him a source of wonder that there should be a shadow of a doubt in any mind as to the type of material, or materials, that are best adapted to good roads construction.

Within the larger cities throughout the country lies the answer to the road question. They have no paving problem, no lengthy discussions are brought out at each new contract as to the type of pavement to lay. Native Lake asphalt laid on a Portland Cement concrete base, known as sheet asphalt, has withstood the heaviest traffic in large and small cities throughout the United States; in some cases, for over a quarter of a century, without damage.

If such a type of highway surfacing has carried the weight of the heaviest city traffic for such a long period of years, why will it not even more adequately answer for the lighter rural traffic for even a longer period of years?

It may be said that sheet asphalt is too high in price, but a survey of recent biddings on reinforced concrete roads will convince the most skeptical that the difference in price is negligible, and when the yearly maintenance figures are compared, it will be found that the sheet asphalt pavement is by far the cheaper.

It is by combining the two standard road and street materials that true efficiency is reached.

The Native Lake asphalt top, mixed with mineral aggregate from small stone to limestone dust, furnishes a waterproof, even, and resilient top which protects the concrete base from the weather and prevents the heaving and cracking so common to the all-concrete road. The concrete base, thus protected, furnishes a rigid support for the asphaltic top, and in this manner the two materials are devoted to the purposes for which they are best adapted by nature.

These conclusions have been reached after long and varied practical experience in the road building industry, and are presented very briefly merely to point out that in the writer's opinion a large mountain is after all being made out of a very small mole hill.

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Elections

THE CIVIL ENGINEER takes pleasure in announcing the elections of Francis A. Regan, '21, of New York City, to the position of Assistant Business Manager, F. Ellsworth Conkling, Jr., '22, of Patchogue, L. I. and Dwight L. Copeland, '22, of West Bridgewater, Mass., to the positions of Associate Editors, and Howard E. Whitney, '22, of Albany, N. Y., to the position of Associate Business Manager.

In This Issue

Lieut. Col. F. W. Scheidenhelm, '01, addressed the convention of the American Water Works Association last June on the subject "Keeping the First Army Supplied with Water." Revised notes of this address were published in the November issue of the *Journal of the American Water Works Association* and we have deemed them of sufficiently general interest to reprint in the February CIVIL ENGINEER. Supplying water for the men, animals, railways, and hospitals of the entire First Army was no small responsibility and it was this which was entrusted to Lieut-Col. Scheidenhelm. As he indicates, the quantities of water handled at any one point were small and in the

Water Supply Service, as in many other branches of the A. E. F. in which engineers of high rank rendered signal service, resourcefulness and executive ability were greater assets than technical skill.

Tests of 63-inch core-joint reinforced concrete pipe to determine whether or not pipe supplied fulfilled specifications and ,to establish a basis for future specifications are described in this issue by Mr. Robert L. Fox, '09, City Engineer of Bethlehem, Pa. The tests included impact tests of the pipe under trench conditions and showed that the deflection produced by the impact of 1500 pounds of loose rock dropped at a height of twenty feet was practically equvialent to the deflection occurring under a concentrated load in the testing machine of 1,600 pounds per lineal foot.

Concrete roads have been found so generally serviceable and satisfactory that any innovation in their construction is sure to be received with interest. In this issue Mr. A. S. Mirick, '01, describes concrete road construction in Nebraska where the use of Platte River sand-gravel aggregate gave very satisfactory results. The success of this experiment is of especial note since it opens up a vast supply of easily obtainable concrete aggregate in a State which heretofore has been hard-pressed for a suitable aggregate supply. The use of the most improved machinery and of Ford trucks in place of teams greatly expedited the work, according to Mr. Mirick.

COLLEGE NOTES

Farmers' Week The date set for Farmers' Week this year was February 9 to 13. The program was more extensive than ever before. Particular emphasis was placed on the problems of marketing and readjustment of agriculture to after-war conditions and a number of prominent speakers had been secured.

Tuesday of Farmers' Week was designated as "Market Day." On this day Mr. E. S. Bayard, editor of the *National Stockman and Farmer*, and a number of other prominent men addressed the convention on problems of marketing. On Wednesday the Department of Rural Education featured an educational program and Dr. J. H. Finley, Commissioner of Education at Albany, was the principal speaker. Thursday was called "Thrift Day" and Governor A. L. Smith and Mr. Frank Vanderlip of New York City addressed the entire assemblage. There were also other speakers on this day who spoke on the Thrift Program. On Friday a forum for the discussion of civic problems was held at which President Schurman presided

The Home Economics Department arranged a special program and had secured a number of prominent speakers. In this department Tuesday was called "Health Day" and Wednesday "Children's Day."

An interesting part of the program this year were the exhibits which were made showing the work of each of the different departments. Also during the week a number of different agricultural societies held conferences.

This year's attendance was not as large as that of last year due to the prevalence throughout the country of influenza and the bad travel conditions but the week is felt to have been highly successful.

The Interfraternity Hockey League Plans

The Interfraternity Hockey season opened on Saturday, January 10. The games are all to be played on Beebe Lake, the preliminaries being played first and the finals later in the winter. Twenty fraternities belong to the league and these are divided into four groups. The winner in each group will contest for the championship of the league at the end of the season. The teams in the league have been divided as follows:

League I: Alpha Delta Phi, Eleusis, Kappa Sigma, Phi Delta Theta, Zodiac.

League II: Chi Psi, Delta Chi, Kappa Alpha, Phi Kappa Psi, Sigma Upsilon.

League III: Alpha Chi Rho, Delta Tau Delta, Sigma Alpha Epsilon, Sigma Phi, Theta Delta Chi.

League IV: Beta Theta Pi, Phi Delta Sigma, Psi Upsilon, Sigma Pi, Zeta Psi.

Cornell Civil Engineering Association Lecture

On Monday evening, January 19, 1920, Henry R. Lordly, C.E., F.S.E., M.E.I.C., delivered a lecture on the subject of Subaqueous Concrete Construction. The lecture was illustrated and showed some very interesting as well as instructive views of the Canal running through Montreal, Canada, the structure on which Mr. Lordly had a great deal of experience.

Mr. H. R. Lordly is a Cornell Civil Engineer of the class of 1893, and is the present McGraw Fellow in C.E. at Cornell University. He served for three years, 1916 to 1919 overseas in the war, first as Lieutenant-Colonel commanding the 5th Canadian Pioneers and latterly as an engineer officer with the British service. The singular distinction of being elected a fellow of the Society of Engineers at London, England, was given to him because of the engineering work which he has accomplished overseas while employed with the Imperial Forces. The Society of Engineers has a restricted membership and amongst its members are many of the most eminent engineers in the Old Country, Colonel Lordly has been granted two patents in connection with concrete construction, both of which have been successful. One of the patents is for a concrete pile with a jetting and sucking device, and the other is for a concrete block cast around sand cores. Before going over seas Mr. Lordly was for many years in charge of the rebuilding of the Lachine Canal, and it was on this work that he talked Monday night at the second Cornell Civil Engineer Association Lecture.

After the lecture there was a get-together for the C.E. students in the Materials Lab. which is now being used as the college smoking room. Stunts of all kinds were seen, and the piano, which has just been placed in the Lab for the use of the Lincoln Hall men, was kept busy. Smokes and refreshments were served.

The Cornell-Dartmouth Basketball Game

The Cornell Varsity won its second league game at Ithaca on Wednesday, January 22, when it beat Dartmouth by the overwhelming score of 35 to 9. Cornell gained the lead early in the game and soon ran up such a score that it would have been impossible for the visitors to take the lead. At the end of the first half the score was 23 to 3 in favor of Cornell. In the second half the green combination made a feeble rally but succeeded only in trebling their score. Molinet made five baskets and Porter followed a close second with four field goals and eleven out of fourteen baskets on fouls. This was the best exhibition of foul shooting that has been seen on the local floor this year.

IN MEMORIAM

Albert J. Himes, C.E., Class of 1887.

Died at Cleveland, Ohio, November 3, 1919

Albert J. Himes, C.E., '87, died at Cleveland, Ohio, on November 3, 1919. He was born in Oswego, N. Y., November 14, 1864 and entered Cornell with the class of '87, graduating with honors in the Civil Engineering course. After graduation he was engaged in various kinds of engineering work until 1901, when he entered the employ of the N. Y. C. and St. L. R. R. as bridge engineer. He became in turn assistant chief engineer, engineer of grade elimination, and valuation engineer, holding the last position at the time of his death. He was the organizer of the Cleveland Cornell Association and was for three years a member of the Advisory Board of Editors of The Cornell Civil Engineer.

ALUMNI NOTES

'79. James C. Kennedy is practicing civil and mining engineering at Fermington, Nevada.

'88. John G. Sullivan, has been elected alderman from the first ward for the city of Winnipeg, Manitoba, Can.

'92. Earnest H. Baldwin, who for the past two years has had supervision of construction work in South America for Guggenheim Bros., has been appointed Chief Construction Engineer, Sinclair Refining Co., Conway Building, Chicago, Ill.

'93 M.C.E., '96 M.M.E. Harry T. Cory, Consulting Engineer, U. S. Reclamation Service, sailed for Egypt on January twentieth, where he will serve as a member of an international commission of three which is to pass on plans for irrigation work on the valley of the Nile.

'96. Major Frank S. Senior is with the Arthur McMullen Co., 149 Broadway, New York City.

'01. Lionel M. Levine is now in charge of engineering design and construction for the J. H. Ladew Company, tanners of sole leather, Newark, N. J. He lives at 539 Manhattan Ave., New York City.

'04. Ross M. Riegel has been transferred from Associate Member to Member of the American Society of Civil Engineers. He is Assistant Designing Engineer for the Miami Conservancy District, Dayton, Ohio.

'05. Thomas Fleming, Jr., has withdrawn from the firm of Chester and Fleming and become associated with the Oil Well Supply Co., of Pittsburgh, Pa.

'05. Captain Thomas L. Fountain has been transferred from Associate Member to Member of the American Society of Civil Engineers.

'05. Carl W. Hæfner has been elected an Associate Member of the American Society of Civil Engineers.

'05. Lieut. Melvin S. Rich has been transferred from Associate Member to Member of the American Society of Civil Engineers.

'05. Nathan N. Tiffany was re-elected Supervisor of the town of East Hampton, N. Y., at the November elections. He is chairman of the Board of Supervisors of Suffolk County.

'06. Eugene D. Burnell has been transferred from Associate Member to Member of the American Society of Civil Engineers. He is Construction Engineer for Adams, Evans & Co., 30 Church St., New York City.

'06. A daughter, Nancy Hamlin, was born to Mr. and Mrs. Robert H. Knowlton on November 20, 1919.

'07. Joseph Gallagher gives his address as 1364 Erving St., N. W. Washington, District of Columbia.

'07. Ford Kurtz has been elected a Member of the American Society of Civil Engineers. He is still employed at Muscle Shoals, Ala.

'07. A daughter was born on November 11th to Mr. and Mrs. Antonio Lazo of 108 East 82d St., New York City.

'07. Capt. John B. Whipple has been elected an Associate Member of the American Society of Civil Engineers.

'08. Meyer Davis is Manager of the Metal Products Department of the H. H. Robertson Co., Room 1007, First National Bank Building, Pittsburg, Penn.

'08. Major Edward A. Wood has severed his connection with the Texas State Highway Department and is now Resident Engineer for the Metropolitan Development Association, Chamber of Commerce, Dallas, Texas.

'09. Albert Diamant has returned to Tocopilla, Chile. where he expects to remain for three years more.

'09. Gustav J. Requardt has been transferred from Associate Member to Member of the American Society of Civil Engineers.

'09. Robert B. Stanton, Jr., is Manager of the Foreign Sales Department of the United States Cast Iron Pipe and Foundry Co., 71 Broadway, New York City.

'10. Clement E. Chase is Assistant Engineer with Ralph Modjeski, in charge of the New York office, and is in charge of the Pittsburgh and New York District for Modjeski and Angier.

'10. A. Carl Lee has been transferred from Associate Member to Member of the American Society of Civil Engineers.

'10. Lieut. L. Levine has been elected an Associate Member of the American Society of Civil Engineers.

'10. Percy S. Monk was married on September 27th to Miss Virginia Ehrhardt, of Augusta. Ga. Monk is a structural engineer with the division of Valuation, Interstate Commerce Commission, Chattanooga, Tenn.

'11. Major Octave DeCarre, C.A.C., gives his address as Golden House, A. E. F., London, England.

'11. Captain R. L. Tate sailed about the middle of February for Dutch Guiana, South America, where he will take a position as Assistant Engineer with the Surinamche Bauxite Maatschappif, a subsidiary of the Aluminum Company of America. His address is P. O. Box 218, Paramaribe, Dutch Guiana, S. A.

'11. Ping Ye Tsai has been elected an Associate Member of the American Society of Civil Engineers.

C.E., '11. M.C.E., '12. Mr. and Mrs. Horace A. Vanderbeck of Shanghai, China, announce the birth of a daughter, Elizabeth Anne, on October 22d. Vanderbeck is Dean of the Department of Civil Engineering at the Government Institute of Technology at Shanghai. He is now on leave and may be reached at Sommerville, N. J.

'12. George A. Belden has been transferred from Junior to Associate Member of the American Society of Civil Engineers.

'12. John T. Child has been transferred from Junior to Associate Member of the American Society of Civil Engineers.

'12. Clifford C. Johnston is a Crude Rubber Broker and Estates Agent. His residence is Singapore, Straits Settlement.

'12. Tao King has been transferred from Junior to Associate Member of the American Society of Civil Engineers.

'12. Alfred K. Starkweather has changed his address to 19 South St., Bloomfield, N. J.

'12. Samuel J. Walzer is in the firm of Walzer Brothers Corporation, Engineers and Builders, 44 Court St., Brooklyn, N. Y.

'13. Mr. and Mrs. William H. Barnard, Jr., announce the birth of a daughter, Elizabeth, on November 25th.

'13. Robert Levy gives his address as 107 Greene St., Lynn, Mass.

'13. Lieut. Harvey T. Munn has been transferred from Junior to Associate Member of the American Society of Civil Engineers. He is a Civil Engineer with the E. I. Du Pont de Nemours Co., at Wilmington, Del.

'14. John A. Dittrick gives his address as 2555 Grand Concourse, New York City.

'14. Linton Hart, formerly with the Raymond Concrete Pile Co., has, with J. J. Collins and W. D. Hammond, formed the Rollin Construction Corporation. The concern will engage in general construction, with offices at 90 West Street, New York City, and 80 Boylston Street, Boston, Mass.

'14. Major Joseph A. W. Iglehart is now Manager of the Baltimore office and member of the firm of Brooke, Stokes & Co., bankers, members of the Philadelphia Stock Exchange. A daughter, Jane Margaret Carey, was born to Major and Mrs. Iglehart on October 3, 1918.

'14. Captain Thomas T. Newhold is Engineer for Irwin & Leighton and is at present working on the construction of a dirigible hangar for the Navy Department. His address is Box 166, Lakehurst, N. J.

'14. John M. Phillips is Resident Engineer of Boonton, N. J., and lives on Lathrop Ave.

'14. Christian Schwartz gives his address as 2961 West Grand Boulevard, Detroit, Mich. He is in the research laboratory of the Studebaker Corporation, Plant No. 15.

'14. Benjamin L. Smith has been elected an Associate Member of the American Society of Civil Engineers.

'14. Adrian K. Webster left the Illinois Central Railroad last April and has since been in Texas improving his ranch His address is Box 3, Vega, Texas.

'15. Mr. and Mrs. Howard B. Wright of Chicago announce the birth of a son, Robert Howard, on October 12th. Their address is 6038 Dorchester Ave.

'15. Lieut. David N. Milhan is Designer and Draftsman with the Sinclair Refining Co., Conway Building, Chicago, Ill. He was married on October 1, 1919 to Miss Thelma Smith, University of Colorado, '14.

'15. Edward J. Thomas is Assistant Superintendent of the Barksdale, Wis. Works of the Du Pont Chemical Co. His address is P. O. Box 832, Washburn, Wis.

'16 M.C.E. Joseph H. Ehlers is an engineer with the Alaska Junean Gold Mining Co., at Junean, Alaska.

'16. Lieut. Leslie E. Pierce has been elected a Junior in the American Society of Civil Engineers.

'17. Henry H. Batjer was discharged as Captain of Engineers on September 8th and is now employed by the City of Abilene, Texas, in the construction of a new reservoir and pipe line. His address is 546 Hickory Street.

'17. Joseph P. Blundon has been elected a Junior Member of the American Society of Civil Engineers.

'17. Ensign F. P. Scileppi is a detailer with the McClintic-Marshall Construction Co., at Pottstown, Pa.

Ex.-'18. William C. Jaeger is Resident Engineer for the Boone County, West Virginia, Highway Department.

'18. J. Ward Martin has entered the firm of Morgan & Martin, Drilling Contractors, Sapulpa, Okla.

'18. Ross W. McKinstry has been elected a Junior in the American Society of Civil Engineers.

'19. John C. Gebhardt gives his home address as 45 North Nineteenth St., Harrisburg, Pa. He is employed as detailer with the Bethlehem Steel Bridge Corporation at Steelton, Pa.

'19. Charles J Howell is living at the East Liberty Y. M. C. A., Pittsburgh, Pa., and works for the Pittsburgh-DesMoines Steel Co.

'19. Charles A. Stott is with Charles G. Stott & Co., Inc., paper and stationery, Washington, D. C.

'19. Nai-Zung Zee, M.C.E., has been elected a Junior in the American Society of Civil Engineers.

GOVERNMENT NEEDS DRAFTSMEN

The United States Civil Service Commission announces that the Government is in need of a large number of draftsmen of various kinds. It is stated that fully 1000 draftsmen were appointed in the Government service during the last calendar year. During this period of reconstruction technical men are especially needed. Besides draftsmen there are openings for surveyors and computers, also assistant and associate engineers, electrical, mechanical, civil, chemical, and ceramic.

Further information and application blanks may be obtained from the secretary of the U. S. Civil Service Board at Boston, New York, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, St. Louis, New Orleans, Seattle, or San Francisco, or from the U. S. Civil Service Commission, Washington, D. C.

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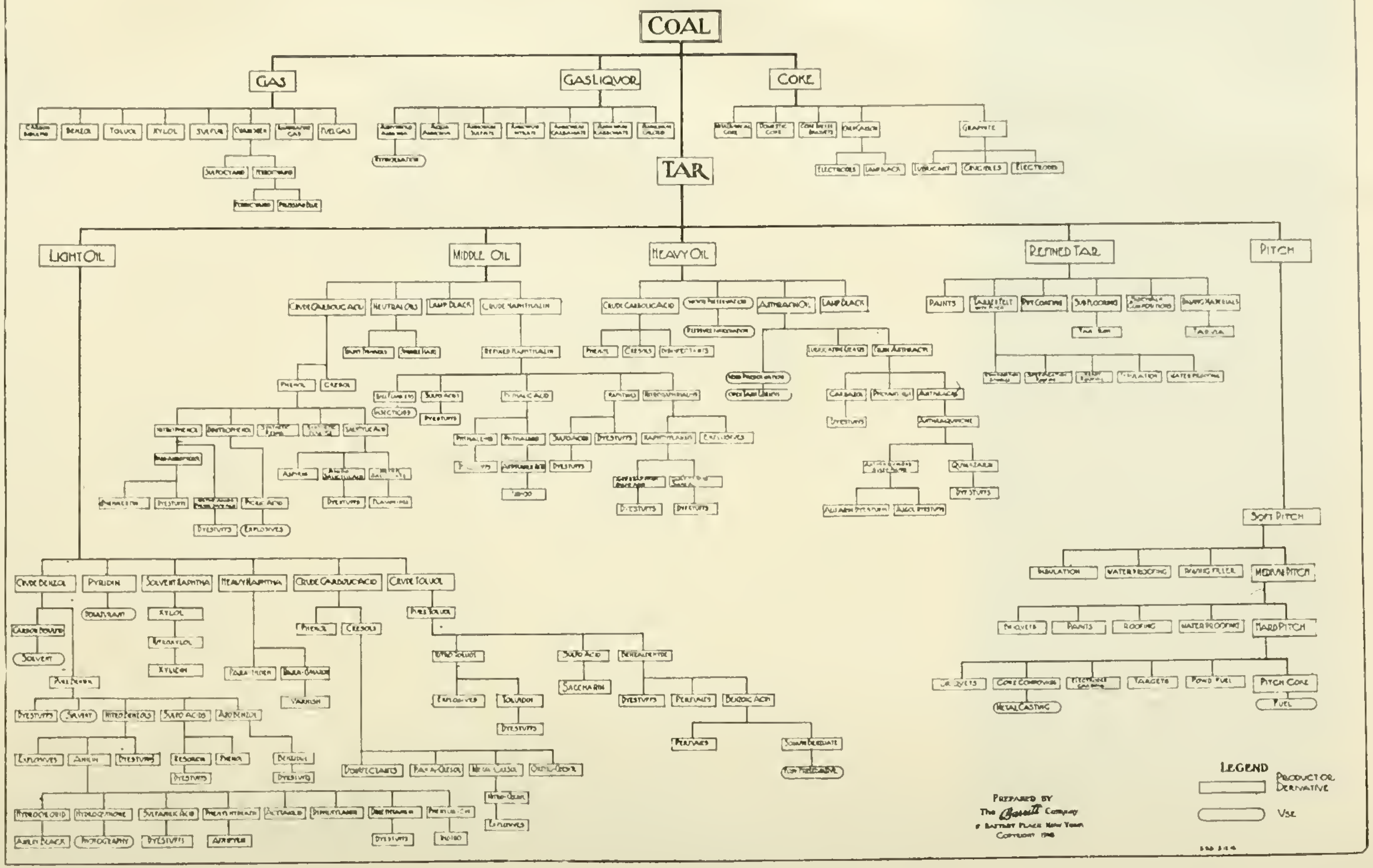
DIAGRAM OF THE PRODVCTS DERIVED FROM COAL AND SOME OF THEIR VSES



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ANTISEPTIC TREATMENT OF TIMBER

By Everett E. King, '11
Professor Railway Civil Engineering, University of Illinois

Engineers and chemists have been working for centuries to get some kind of preservative that would fully protect wood from the ravages of decay. No doubt, the great advancement made in timber preservation in recent years was due to the fact that the supply of timber was growing scarcer and the price was getting higher. When timber was plentiful and cheap there was not so much need felt in the average case for prolonging the life of wood by what were considered somewhat expensive processes; but now that the prices both of materials and labor are rapidly rising, the engineer is obliged to consider efficiency not only in the first cost of construction, but also in the maintenance and renewals.

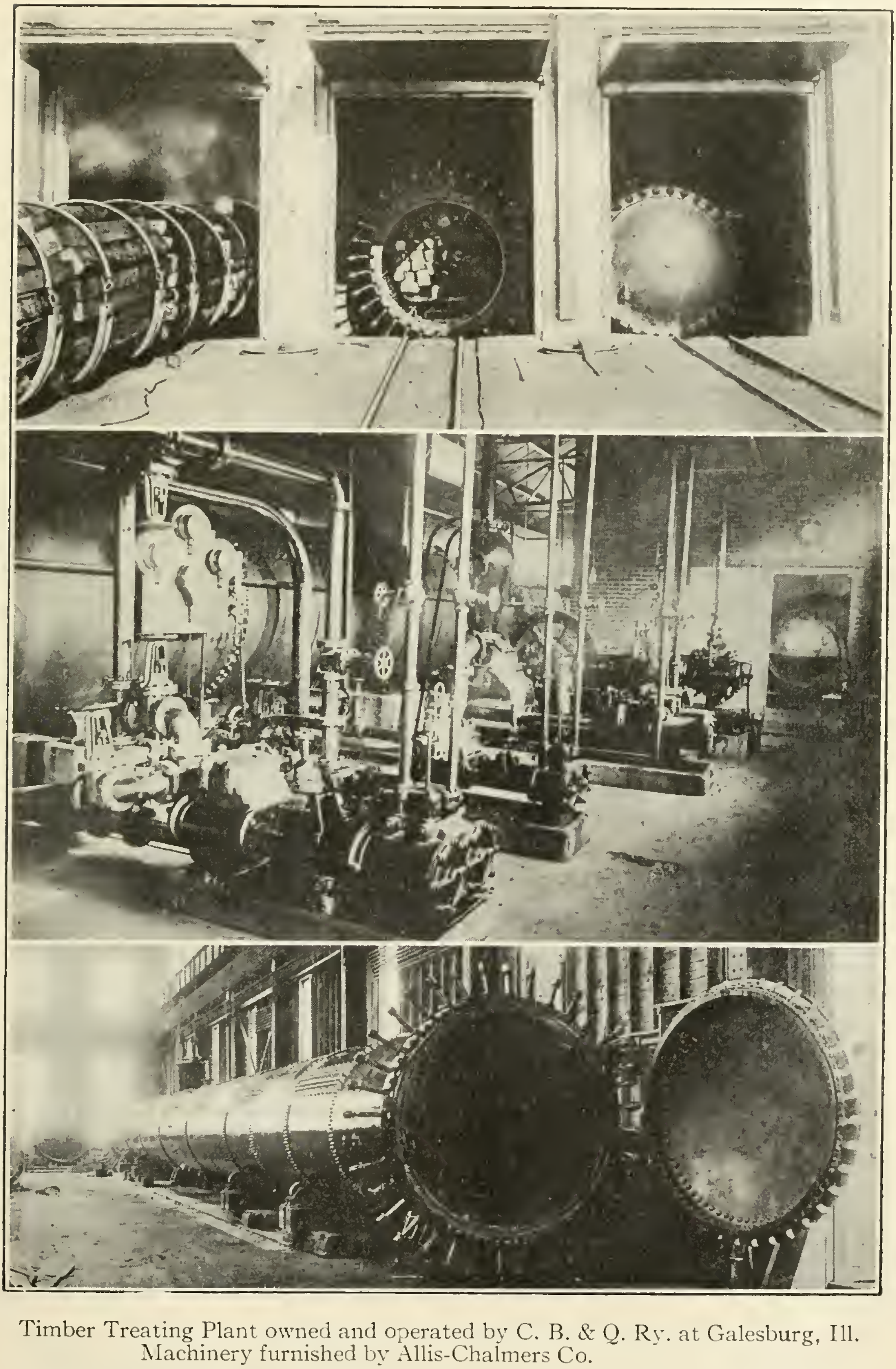
Formerly it was thought that decay was the result of the fermentation of sap; now, however, it is known to be the result of a low form of plant life called fungus. The fungi grow in threadlike forms that penetrate the cells of the wood. They are able to secrete an enzyme or ferment that acts on the organic matter in the walls of the cells dissolving it and using it for food. These little plants use this food as large plants use their food from the soil. These threads gradually extend their numbers through the wood eating their way through the walls from cell to cell. When they finally consume all of the organic matter in the timber, they leave the remainder of it in a state of collapse called decay.

As sapwoods have more protoplasm in their cells than heartwoods and consequently more fungus food, they are more subject to decay than heartwoods. For this reason untreated sapwood is used very little in timber construction. Seasoned and treated with a proper preservative, however, it gives entirely as good service as heartwood and is much more easily treated because of the absence of tyloses and resin ducts that are commonly found in the heartwoods of so many timbers.

In addition to food, fungi require for rapid growth, air, moisture, and a proper condition of temperature. As the food supply is found to be the only one of these elements that can be sufficiently controlled on a commercial scale to prevent the action of decay, nearly all the efforts toward timber preservation have been spent in the attempt to render the organic material unfavorable for fungus growth. The most common method has been to apply to the wood some toxic fluid that has poisoned the food and destroyed the fungus in the early stage of its propagation. The preservatives generally employed in present-day practice are creosote and chloride of zinc.

The creosote made in this country is a by-product of the manufacture of coal-tar distilled from bituminous coal in a retort free from air so that there cannot be any combustion at high temperatures. As shown in the accompanying diagram, coal when heated to such a temperature as will produce destructive distillation gives off gas, gas liquors and tar, leaving a residue, coke. The tars when properly reheated in a closed retort give off light oils, middle oils, heavy oils, refined tar and pitch. The light oils are those lighter than water and the heavy oils are those heavier than water. Creosote is a product of the heavy oils; and most of the standard engineering specifications require that its specific gravity shall lie between 1.03 and 1.10. These heavy oils distill between the temperatures of 210°C and 355° C. These include the napthalenes and anthracenes, both of which are practically insoluble in water,—a very necessary characteristic of a stable preservative. The high temperature of distillation prevents any serious loss from evaporation.

The simplest and oldest method of timber treatment is to apply the liquid with a brush or mop, spreading it over the surface and repeating the application to insure a good penetration into the cracks and checks. The second coat is not applied until the first one has dried. While this is the simplest and cheapest way, it is the least effective, for the only claim that can be made for it is that it simply provides a thin external coating for the wood. Any checks that may develop after the treatment is applied will expose the untreated surfaces where the fungus may begin to grow. Another method of securing the same results that the brush treatment gives is the spraying process, where the preservative is applied in the form of a spray just as is done in the case of paint. Whether it is applied by brush or spray, however, the fluid should be heated to a temperature of between 150° and 200° F in order to get some penetration. Practically the only items of expense in connection with this method of treatment are for the creosote and the labor to apply it. The only equipment necessary is a small container in which to hold and heat the oil, and one to catch that which runs away in case the liquid is poured on and mopped.



Timber Treating Plant owned and operated by C. B. & Q. Ry. at Galesburg, Ill.
Machinery furnished by Allis-Chalmers Co.

Machinery Room Timber Treating Plant B. R. & P. Ry. Co., Bradford, Pa.
7' 0" x 121' 0" Timber treating cylinder Brunswick Creosoting Co., Brunswick, Ga.

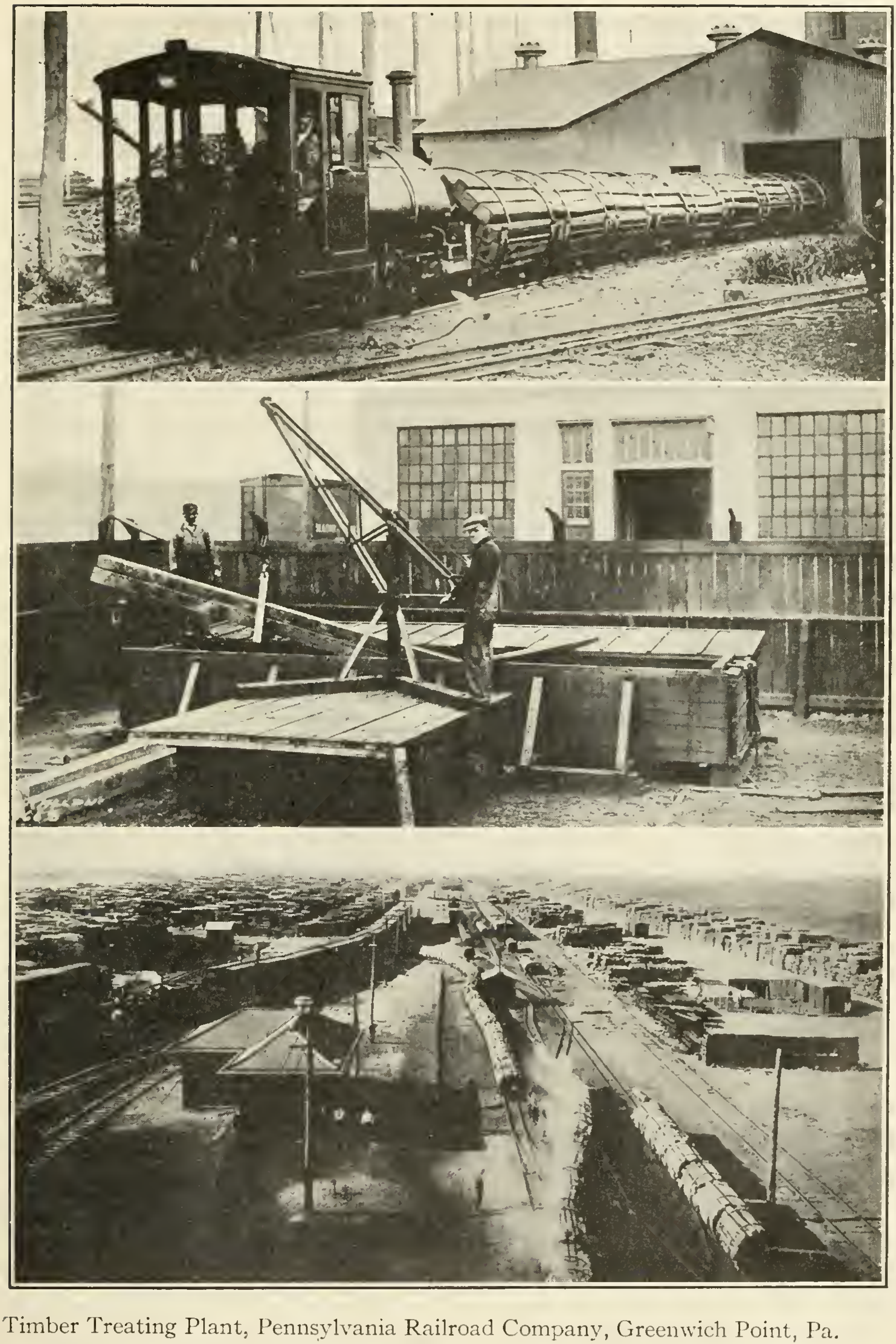
ANTISEPTIC TREATMENT OF TIMBER

Photos Courtesy of Allis-Chalmers Co., Milwaukee, Minn.

The dipping process in which the timber is immersed in the hot preservative affords a method for getting a slightly deeper penetration and a means for filling more effectively the cracks and checks. The wood is immersed for from fifteen to twenty minutes, when it is removed and laid aside to dry. The oil should be heated to a temperature of from 180° to 210° F in order to get some penetration. When there is enough timber to warrant the construction of a tank, the dipping process will usually be found to be more economical than the brush method. The kind and size of tank will depend upon the size of the timber and the purpose that it will serve. The oil may be heated by a steam coil placed along the bottom of the tank or by a fire built underneath, especially in the case of the upright tank. Where the entire surface of timber is to be treated, some means must be employed to keep it submerged. Where the pieces are heavy they should be handled by a derrick or some such mechanical appliance. A pair of tongs will suffice where the timber is light, but in no case should the liquid come in contact with the hands.

These two superficial processes, the brush and dipping methods, have their best application in the treatment of small quantities of light timber where the circumstances do not warrant installing more expensive equipment or shipping the timber to such plants as are already installed. They are valuable in the treatment of thin boards used where the air is comparatively dry and where the odor, which remains for a short time after treatment, is not a detrimental factor. They are valuable, also, in protecting joints and such other portions of structural timbers as are especially subject to decay in order to make them last as long as the unprotected portion in the remainder of the structure. Before any attempt is made at treating by one of the superficial processes, the timber should be properly dried in order to get the desired effect.

The dipping process may be prolonged to what is known as the open-tank treatment. No additional equipment is necessary except that a stronger derrick is sometimes required on account of the heavier timber handled. The creosote is heated in the open-tank to a temperature of from 180° to 210° F. After the wood is submerged this temperature is maintained for a period of from two to six hours depending upon the structure of the wood, the moisture content and the penetration desired. A porous dry wood, free from tyloses would require much less time than dense wood full of moisture and resin ducts. The heat of the oil gradually raises the temperature of the timber, driving out some of the air and moisture and expanding the remainder. After the wood has been heated a sufficient length of time, it is subjected to a cooling process to increase the depth of penetration. During this cooling process the air and moisture that remain in the cells of the wood, contract, forming



Timber Treating Plant, Pennsylvania Railroad Company, Greenwich Point, Pa.
Treating Timber by the Dipping Process.
Timber Treating Plant owned and operated by C. B. & Q. Ry. at Galesburg, Ill.
Machinery furnished by Allis-Chalmers Co.

ANTISEPTIC TREATMENT OF TIMBER

Photos courtesy of Allis-Chalmers Co., Milwaukee, Minn.

a partial vacuum into which the normal external air pressure forces some of the preservative oil. The reduction in temperature may be effected by transferring the heated timber to a tank of cold creosote, where the chill will be comparatively sudden with a corresponding rapid impregnation, or by leaving the timber in the heated oil and allowing it all to cool together. A limited number of experiments show a greater penetration during the period of cooling than during the time of heating.

The open-tank process offers a practical means for treating posts and poles where only a portion of each piece is submerged and for treating other heavy timbers where a pressure plant is not at hand. The best results seem to appear in the case where, with well seasoned timber, there is a layer of sapwood entirely surrounding the heartwood. The preservative easily penetrates the sapwood and affords a protection to the heartwood.

The pressure process is employed to treat timbers that are subjected to continuous moisture and to continuous or even occasional mechanical wear. The preservative is injected into the interior of the wood much more thoroughly than can be done by the other methods. The depth of penetration depends upon several conditions, among which are the amount of seasoning, the kind of wood and the character of its elements, the method of impregnation and the ingredients in the preservative. Pressure plants involve large expenditures in the first cost of construction and justify themselves only where there is an opportunity to handle large quantities of timber. This implies an additional expense, in many cases a serious one; for the timber must be shipped from the source of supply to the plant and then reshipped to the point where it is intended to be used.

Whatever method is employed in the preserving process, the timber should be bored and finished to size before the treatment is applied. If any cutting should become necessary afterwards, the unprotected surfaces should have a good application by one of the superficial processes. All the bark should be removed to allow a deeper and more uniform penetration. The oils used in the pressure process can be slightly more volatile than those employed in the other methods, for with the deeper penetration there is less likelihood of evaporation.

The plants for treating timber by the pressure process are somewhat elaborate, yet they are all arranged and operated on the same general plan. The storage yard is generally located adjacent to the treating plant where the timber is piled to dry before any attempt is made at treatment. The timber stores here should be arranged so that every piece should have good exposure to circulating air. The yard should be well drained, free from weeds, grass, rubbish and rotten wood. A layer of cinders spread over the ground makes a splendid surface for the storage yard.

There are usually two or more retorts or cylinders set to the proper grade so that the tracks laid in the yard can be continuous into the retorts. The commercial sizes of these cylinders vary from five to nine feet in diameter and from forty to one hundred and eighty feet in length. The steel shell is made of open-hearth steel plates that vary from three-eighths to one inch in thickness, depending upon the pressure applied for treatment. The track within the cylinder is the same gauge as the ones in the storage yard, so that the trains that bring the timber from the yard may run directly into the retort. Between the rails within the cylinder are long steam coils that heat the preservative oil. An interesting feature of the cylinder is the door. As the pressure of the liquid sometimes reaches 250 pounds a square inch, the construction of the door must be such as to withstand this pressure and remain hermetically tight. The simplest type is made of cast steel with slots around the rim, which engage the T-head swing bolts fastened to the end of the retort.

Large steel tanks for storing the oil form a necessary part of the equipment. These are so elevated and connected to the retorts that the liquid will flow into them by gravity. Pumps are required, however, to maintain the necessary pressure for penetration and to return the surplus oil from the cylinders to the storage tanks after the treatments are finished. There must be an ample system of fire protection with elevated tanks, pumps, pipes and hydrants. Ties, piling and other heavy timbers are sometimes handled by means of locomotive cranes. The tram trains loaded with timber are often moved to and from the treating cylinders by small steam or electric engines.

The methods of applying pressure treatments with creosote are divided into two classes, the "full-cell" process and the "empty-cell" process. The full-cell process is one of the oldest methods of treating timber and, as its name implies, it involves forcing into the wood all of the preservative that it will contain, not only insuring a deep penetration of the preservative oil, but also filling all cell space with the toxic fluid, barring any possibility of fungus growth. After the timber is run into the retort and the heavy steel door is closed by the T-bolts or other fastenings, the timber, especially if it is unseasoned, is subjected to a steam bath with a pressure varying from ten to twenty pounds a square inch for a period from two to twelve or fifteen hours, depending upon the size of the timber and the amount of seasoning necessary. More and more of the seasoning must be done in this manner as time goes on and timber grows scarcer, for it is not always possible to keep a supply on hand sufficiently in advance for proper air-seasoning. A vacuum of from twenty-two to twenty-four inches follows the steam bath for from two to three hours to remove the excess moisture. This much of the process may be omitted if the timber is sufficiently air-dried before the treatment is begun. The cylinder is then filled with creosote at a temperature of approximately 120° F and the pressure raised by the pumps to between 120 and 180 pounds a square inch. The steam coils in the cylinder soon bring the temperature up to about 180° F. These values of pressure and temperature are maintained for several hours until the proper amount of preservative, measured by the recording gauges, is injected into the wood. The purpose that the timber is intended to serve determines the amount of oil forced in, which varies from 10 to 24 pounds to the cubic foot. The cylinder is then emptied of the oil, and a vacuum is generally created to reclaim any surplus oil that might otherwise be lost by dripping. The door is then opened and the timber withdrawn from the tube, completing the cycle of the full-cell treatment.

This process finds its best application in treating timbers that are not subject to mechanical wear, but which fail primarily from decay involving a heavy item of expense for renewals, such as piling and other members used in the construction of wooden bridges, piers and wharfs. It is practically the only treatment that will resist the action of marine borers. The process is an expensive one on account of the amount of oil injected, but justifies itself in cases where there is no mechanical wear by prolonging the life of the timber to twenty or thirty years.

The empty-cell process is somewhat similar to the previous one. The penetration is just as deep, but more of the oil is reclaimed at the end leaving the cells only partly filled. There are two methods used in common practice for applying the empty-cell process, the Rueping and the Lowry. The timber should be preferably air-seasoned in advance; but if it is not, a steaming process is applied as in the full-cell method.

The characteristic feature of the Rueping process is that air under 80 pounds pressure is forced into the cylinder and into the cells of the wood. Creosote is then pumped in under a somewhat increased pressure while the air that collects in the dome of the retort is allowed to escape by a valve in the top. The pressure is increased to about 180 pounds and maintained at that rate until the wood has absorbed all the creosote it can hold. The cylinder is then emptied of the liquid as quickly as possible and a vacuum applied to allow the compressed air in the wood to expand and drive out a large portion of the impregnated oil. Usually only five or six pounds are left to the cubic foot.

The Lowry process is very similar except that the preliminary air pressure is not applied. The oil at a temperature of about 180° F is held at a pressure of from 100 to 175 pounds a square inch until the timber has absorbed all the preservative it can take. The oil is withdrawn and a vacuum created as before leaving about eight pounds of creosote per cubic foot of wood. The empty-cell processes serve their best purpose in treating ties and other timbers that will eventually fail by mechanical wear, for it is clearly evident that any preservative injected beyond that necessary to make the physical life equal the mechanical life is an unnecessary and wasteful expense.

Zinc chloride is extensively used as a preservative on timbers such as ties that fail by abrasion and mechanical wear. It is practically a full-cell process, but the preservative is much less expensive than creosote. If the wood is green, it is seasoned by the steaming process. Steam at twenty pounds pressure is turned into the cylinder after the timber is in place and remains in contact with the wood from three to six hours, depending upon the amount of time that is required to remove the sap. A vacuum of about twenty-four inches follows to assist in the discharge of the surplus sap and moisture. The zinc chloride solution is admitted to the retort and is held under a pressure from the pumps of about 160 pounds until all of the preservative is injected that can be absorbed by the wood. The attempt is usually made to inject enough of the solution to have the equivalent of one-half pound of dry zinc chloride salt for one cubic foot of wood. Zinc chloride is just as toxic as creosote, but suffers the disadvantage of being soluble in water and is rather easily leached away; but a full-cell injection will generally be sufficient to make the physical life of the treated timber equal its mechanical life, especially in sections of moderate rainfall.

The Card process involves a mixture of 80 per cent of zinc chloride solution and 20 per cent of creosote. As the two liquids do not have the same specific gravity, they must have some mechanical means to keep them constantly stirred. A rotary pump serves the purpose best by taking the fluid from the top of the tank and injecting it again through a perforated pipe laid lengthwise along the bottom. It is practically a full-cell process leaving approximately one-half pound of dry zinc chloride in a cubic foot of timber and two or three pounds of creosote.

EXPERIENCES IN SUBAQUEOUS CONCRETE WORK

Henry R. Lordly, C.E. '93
Fellow in Civil Engineering Cornell University, 1919–20

Placing concrete under water, or subaqueous concrete work, is not a new topic but it is one on which little practical data has been presented in the technical press, due probably to the fact that construction engineers are usually reticient about their work. The "Transactions of the Canadian Society of Civil Engineers, 1910," contains a description of five miles of walls on the Lachine canal, faced with concrete by the subaqueous method, the work being in charge of the writer. Since that date he has carried out other important underwater concrete work and believes more than ever in its efficiency and cheapness.

History

The history of laying concrete under water is not voluminous and is largely found in old numbers of the "Proceedings of the Institute of Civil Engineers," the work itself probably dating back fifty or sixty years and being largely in Great Britain. The methods originally tried were (1) Depositing the concrete directly under the water by means of a box with a movable bottom, allowing the concrete mass to get partially set before placing it in the box. (2) Depositing in bags; it must be remembered that the old English Portland cement was a very slow setting cement and allowing the concrete to stand for a lengthy period permitted the cement to form a good bond with some of the materials and thus prevented its being washed away while being deposited. The following abstract from notes in the writer's possession will more clearly explain this point. (From Pro. Inst. C. E., 1886 or 1887).

"The part of the S. W. pier at Garvel Basin, Greenock, below low water was formed of plastic concrete, deposited behind a facing of piles for a thickness of three feet next the piles and composed of two parts of cement and seven of sand and ballast, the concrete behind this being a mix of one to six.*

The former was left to set for three hours, the latter for five hours, before being deposited, the time varying somewhat with the cement used. The best results were obtained when the ingredients were mixed with the smallest possible quantity of water, then at once rammed into the boxes, and deposited under water as soon as the concrete had set to the consistency of stiff clay."

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*(Note that this probably means a 1–1½–2, and a 1–2–4, mix, in the parlance of today.)

Some tests on the above work with a one to three and one-half concrete, by Daniel McAllister, C.E. '11, showed that after setting out of water for 18 hours and then being placed in molds, the concrete formed a monolithic mass when afterwards placed under water. The strength of the mass depended on the time allowed for setting before depositing. If only eight hours elapsed between mixing and depositing there was practically no reduction in strength; but with a longer time the strength was gradually reduced and, with an eighteen hour interval, was only about one-half the normal value." (Pro. Inst. C. E. '86 or '87.)

The second method of first placing the concrete in bags, or sacks, or very large canvass retainers, has been quite extensively used and good results obtained. Small bags of thick paper or poor jute, allowed the concrete to settle into place before the bag rotted or broke, or before any of the material worked through, and eventually a monolithic block was formed in this way. At Newhaven, England, (Pro. Inst. C.E. '86 or '87) a breakwater was built by laying very large concrete blocks in sacking, piled transversely on the bottom, thus forming a good foundation for the superstructure. "The one hundred ton sack concrete blocks were deposited from a special barge having a well 42 ft. by 8 ft. and 6 ft. deep. The sacks were of jute canvass 27 inches wide and weighing 20 ounces to the yard. There were four hundred yards of material in each sack, a portion of each sack being of double thickness. The sacks had to be made considerably larger than the hold of the barge to permit the concrete to expand—probably in settling down—without damaging the sacking. The sack blocks in the work settled down to a thickness of about two and one-half feet."

It is, or was, quite a common practice in Great Britain to lay ramp walls to prevent the erosion of river banks, by cross piling cement sacks filled with a gravel concrete, and allowing the sack to absorb sufficient water to set the cement. This same method, no doubt, has been employed both in America and other countries although this could hardly be called subaqueous concrete in the sense of this paper.

Of late years three methods, other than the above, have been used: The tremie or spout system; the ram system, as employed on the walls of the Lachine canal; and thirdly, the gravity flow method, also employed on the Lachine work. The tremie is simply a spout which is made more or less flexible, particularly at the lower end, in order that it may be moved readily and to prevent the end from being choked as the concrete flows out.

The tremie can be used with depths up to 100 feet, at least, and depends for its success on the ability of its users to keep it supplied with a constant flow of concrete. It has been used on the Detroit tunnel and other works in America.

The ram system is the name given to the first method used in the relining work on the Lachine canal, carried out under the supervision of the writer, but it was only used on thin walls, or where the narrow space between the back wall and the face mold or form might cause the concrete to get jammed and thus prevent its flowing down. In wider spaces the gravity flow system was adopted and the ram discarded.

The slope walls of the Lachine canal, near Montreal, Canada, had to be rebuilt, or faced, without interfering with navigation. A system of large wooden molds, 100 feet by 22 feet, and secured at from 1½ to 2 ft. from the slope walls, was adopted. The mixing plant, which was operated on scows, was provided with a movable oblique arm, at the end of which was built an iron box, with movable top and bottom. This arm, called the ram, carried the concrete down and when at the required depth the bottom of the box was opened by a steel cable and the concrete deposited. At times the ram was not operated but kept near the top and used as a chute, the concrete being deposited in such a manner that it took a natural slope and pushed itself forward; this method will be described later. Plate 1 shows the ram system in operation. The oblique arm is the ram, and the box, which was only 18 inches wide and held one cubic yard, is directly under the chute from the mixer. The top of the mold may be seen just above water.

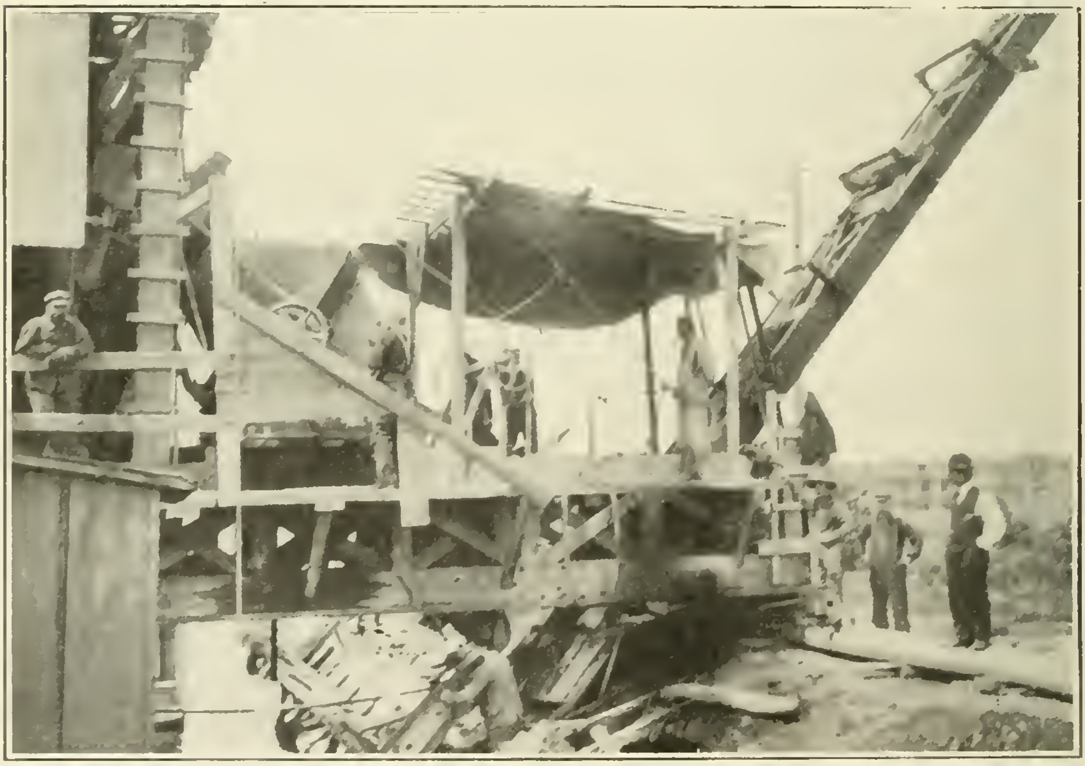

Plate 1

During this work, and in some previous experiences, the writer obtained a fair idea of what happened to concrete, when deposited carefully under water and when, after a body of it had finally reached a height above the level of the water, more concrete was placed on top of this mass. As a result of these experiences and observations, some rather difficult work was later performed by employing this, so-called, gravity method.

On one occasion, while supervising the placing of a concrete foundation for a bridge, the site was drowned out by a spring freshet until there was a depth of 23 feet of water to contend with. To stop the work was out of the question and, as all the forms were in position, it was decided to begin placing the concrete at one end, bringing the mass above water in one corner. This was done by the aid of a chute; later the chute was discarded, and the concrete dumped on the edge of the mass, the added weight helping to push the concrete forward until it approached its natural angle of repose. The amount of material placed in this manner had a length of about 80 feet, and a width of from 8 to 14 feet; upon the removal of the forms the flow lines showing the angle at which the mass moved forward, were readily seen. This method was afterwards carried out in portions of the work previously described and, in particular, on various pieces of vertical walls, in a current of water, and notably the Lachine dam which up to the present, is probably one of the most extensive pieces of under-water concrete work in America; i. e., if we except the five miles of walls in the canal proper.

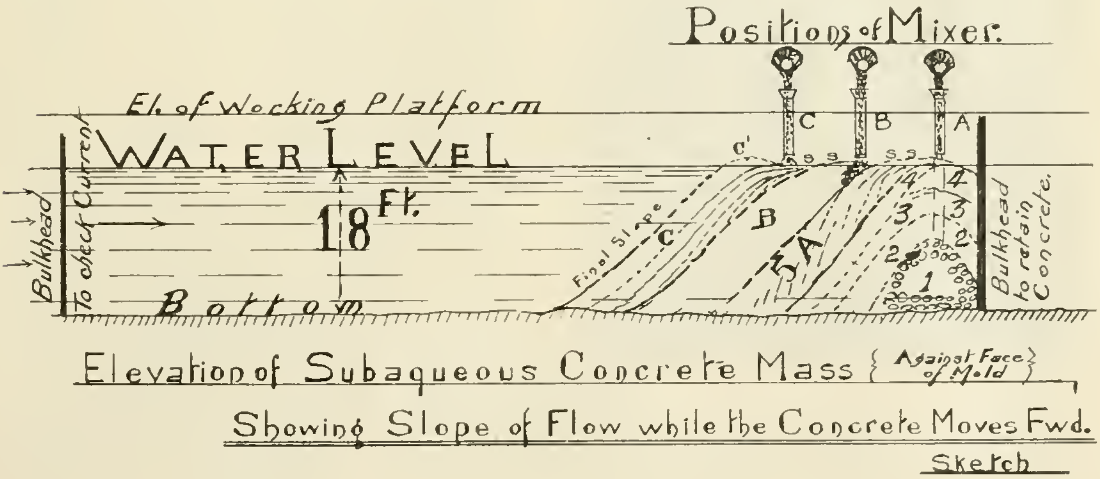
Positions of Mixer.
El. of Working Platform
WATER LEVEL
18 Ft.
Bottom
Bulkhead
To check Current
C
B
A
c'
s s
s s
4
4
3
3
2
2
1
5A
B
C
Final Slope
Bulkhead to retain Concrete.
Elevation of Subaqueous Concrete Mass {Against Face of Mold}
Showing Slope of Flow while the Concrete Moves Fwd.
Sketch

Plate 2

Plate 2 is an illustration of the gravity flow method. The concrete is confined both back and front by molds, or by a mold and a previously built wall or embankment, and at the starting end by a bulkhead.

Work is started in one corner, the position of the mixer being indicated by the letter A in the diagram. The various deposits of concrete take a decided shape as indicated by the figures 1, 2, 3, 4. After the point 4 is reached the concrete is dumped on the top and pushed forward, with little effort, by men with light wooden scrapers or a tool in the form of a rake. It then flows down to take the position indicated by 5A, which represents the last material placed by the mixer at A, before it is moved forward to its second position at B,—and so on. The writer has used this system to build a wall nine feet wide at the bottom, four feet at the top and eighteen feet deep, the structure being in water 17 feet deep and having a flow of 6 or 7 miles per hour. There is nothing difficult about it, everything depending on the quality of the concrete, and on careful supervision.

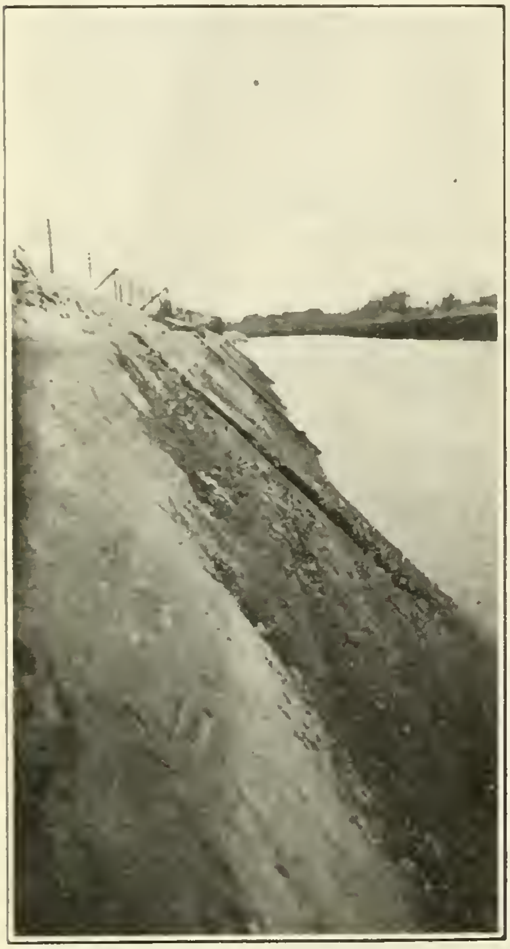

Plate 3

The chief advantage of this method lies in the fact that the concrete flows forward in one direction with its narrowest face for the wash surface; this face is the oblique cross-section shown by the plane of the angle of repose.

Plate 3 shows the face of a slope wall built by the subaqueous method above described.

Plate 4 is a sketch of the method of carrying out the underwater reconstruction of the Lachine dam, in which the "gravity flow method" was employed, under the supervision of the writer. This dam is at the entrance to the Lachine Canal and has a total length of about three-fifths of a mile, one-half mile being reconstructed. It divides the ordinary shore current of the St. Lawrence River from the rapid flow in the middle of the river just as it begins to descend the drop of 45 feet which takes place in about nine miles, the length of the canal. The original dam was built of cribwork and filled with heavy stone, but the repeated action of the ice flows, and natural wear, made it quite unstable. With a head of about one foot there was a flow of water through the dam, portions of which were undermined. The main difficulty was to secure the big 100 foot molds in place, and to stop this flow; it was also necessary to control the current formed by the inward flow of the water towards the mouth of the canal.

The sketch shows a big mold in place and being held in position by the inner and outer steel cables, with posts as struts; this method had also been used during the construction of some of the five miles of walls previously built in the canal. Two seven-eighths inch cables were used on the outside and three five-eighths inch cables on the inside. The outer cable was secured to a short piece of cable, about eight feet long, previously placed by the diver, and secured to the timber cribwork. This short cable had an eye at its end to which was attached the main cable. The sketch shows the diver examining this cable after it had been secured to the top above and tension had been put on it. The inner cable was secured to the mold in such a manner that it could be

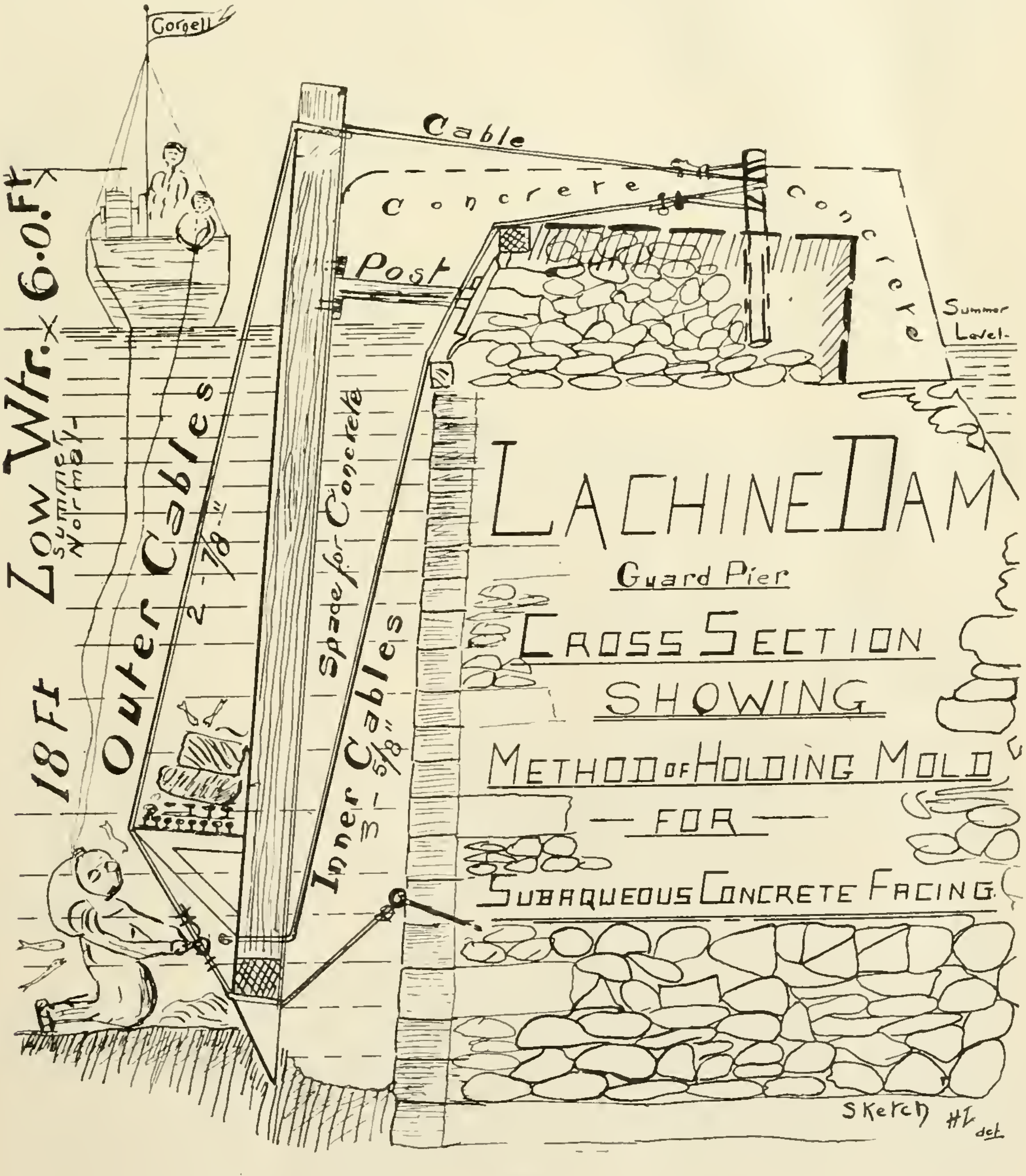

Plate 4

disconnected at the end, or cut by the diver, after the work had been done. The length of cable was left in the wall. The mold was held down by its own weight, plus the dead weight of rails and stone blocks, placed on the platform which is seen above the diver's head.

Before the molds were placed a dredge cleaned out the site and the foundation was further dredged out as seen, partially by machine and finally by the divers. Upstream and downstream bulkheads were used as illustrated in Plate 2 and after these preparations were made the work of depositing the concrete was begun. In several places there was difficulty in stopping the flow of water through the timbers of the dam, and to accomplish this a special method had to be employed. This consisted of using sheets of eleven ounce canvass 24 feet wide, sewed up in lengths of about sixty feet. These were placed against the face of the old dam and secured at the top and bottom, battens being nailed over the vertical joints; in this manner the water was made quite still and when the concrete was being placed no cement was washed through, as was evidenced by the clear water on the outside of the dam opposite the site of operations. No difficulty was experienced in holding the molds and no slides occurred. As a rule these dangers lie in bringing the concrete too high on the first day's work. It is well to fill only part way and permit this to get set, at least over night, before continuing the work.

When once a sufficient length is finished, such as section A in Plate 2, and this sets hard, the concreting can go on continuously and will flow forward without any trouble. The mixing and supply plant used here was all on scows: one scow for mixer, bins, and machinery; one scow for sand; one for stone; and a special covered scow, or barge, for the cement. The diver's outfit was on a small scow containing house and pumping outfit.

Cost

The cost of this work, and the vertical walls, built on the subaqueous system, was not as great as some similar sized walls constructed in the dry, under the supervision of the writer. The contract price of the concrete, per cubic yard, was about the same in each case, but the total cost of the dry walls exceeded the underwater work by the additional expense caused by driving piles; for pumping and in erecting; and for removing the molds by high priced carpenter labor.

In some classes of work it is absolutely necessary to build a cofferdam and to dry the site but in many cases, in still water, the system above described is all that is necessary. Cheap, strong, and interchangeable molds, securely held, and floated into place will cost less to handle than molds erected and taken down in small sections in the dry.

Some reader may ask, "Is the subaqueous concrete work good and safe?" The object of this paper is to answer that question in the affirmative! Surely an experience covering five or six miles of walls, and a dam built under severe conditions, should be ample to form a favorable conclusion, or the reverse if it were necessary, as to the value of subaqueous concrete work!

The writer is now of the opinion that no engineer, who is worthy of the name of a construction engineer, has a right to waste millions of dollars in building expensive cofferdams, and maintaining expensive pumping plants, and still claim he is doing modern work. Today there are other forms of molds available than those used above. Steel sheeting can be used up to at least sixty foot lengths and redrawn on completion of the work; and there are various types of concrete shells, caissons, or boxes, that can be premolded, sunk on the site, and filled with the required content.

The day for expensive cofferdams is over.

Conclusions

In carrying out underwater concrete successfully the points to be noted are:—

(1) The stiffness and rigidity of the forms and the bracing of same; cracks in the molds will cause wash lines.

If working in a current begin at the downstream end and block the upper end by a bulkhead to prevent any wash of the water as it flows down.

(2) Do not commence operations too soon in the year when the water is ice cold, or to continue too late in the fall, for the same reason.

Don't remove the molds too early; although in favorable conditions and with good concrete, five days is often not too soon. Take longer time if vessels are apt to bump against the work shortly after completion.

(3) Materials. All the materials should be the best of their kind. DON'T USE ANY MATERIAL SIMPLY BECAUSE IT CAN BE OBTAINED HANDY. A good quick setting cement should be selected, but only after it has stood satisfactory setting tests in the coldest temperature at which it is going to be used.

The sand should be clean, sharp, and silicious, and should contain graded particles ranging from those retained on a number 80 sieve down to those retained on the number 10 sieve which is usually the coarsest. Some good sands have a small percentage retained on the number 100 sieve with some on the number 6 and make ideal concrete. Sand from Halifax, N. S., from St. John, N. B., from Winnipeg and Vancouver come under the latter class.

The stone should be clean and of good quality as to hardness, and what is generally known as the two-inch size commercially is acceptable. A small percentage of pieces longer than two inches which often work through the crusher will not be objectionable. Shaly limestones that disintegrate after being taken from their natural beds should not be used.

The stone used for the underwater concrete on the Lachine canal was a silica sandstone. It is a very hard stone with an irregular break and is rather severe on the crusher. Cement adheres to it well and for concrete work it cannot be beaten. Water worn gravel should not be used.

(4) Testing and mixing. One bag of cement out of every ten bags should be tested for setting, in addition to the standard tests under which it is purchased. These setting tests should be made at the temperature of the water in which the concrete is to be placed.

Mortar tests, setting in the proportions of cement and sand to be used in the work, should also be made under the above conditions.

A mechanical mixer is necessary on all work of this kind as a constant flow of concrete should be kept up. The concrete should first be emptied into a receiver placed below the mixer from which it can be allowed to flow, as required—the flow being regulated by an automatic gate. A drum mixer is preferable and each batch of concrete should be turned for at least two minutes at the regular speed of the drum before it is deposited into the receiver. From 180 to 200 cubic yards in ten hours may be considered a maximum day's work.

Unless the molds are secured very solidly and their stability is beyond doubt, the depth of any one layer of concrete should not be over ten or fifteen feet although it is always best to come up to water level.

Continuous mixers with automatic measuring devices have no place on an underwater concrete job. Every batch must be up to the standard and be able to stand the inspection of an experienced man who can readily detect an off-mix by its color and consistency.

The proportions of cement, sand, and ballast, should not be decided upon until all of the materials have been inspected and tested. With the present day high standard American cements the proper porportions will be within the limits of a 1 to 2 or 2½, of cement and sand, to 5 parts of stone. Some crushed stone, such as the irregular crushed sandstone when run into the measuring box from an overhead bin, bulks up considerably more than an evenly crushed limestone and this point should be remembered when measuring to get cubic yard results.

The mix should be what is called a putty mix and care must be taken to get the required amount of water; this must be largely a question of observation. Automatic supply tanks for water are not reliable unless adjusted to suit hot or cold weather conditions and must be under constant supervision.

One man should be placed in charge of the cement supply. He will get the bags ready to empty and take care of the bags afterwards and tie them into bundles to be returned to the mill. The tally on the empty bags gives a check on the cubic yards mixed during the day.

(5) Inspection. The inspector is an all important man on any concrete job but particularly so on an under-water one. A man who has had cement-laboratory experience combined with practical mixing of concrete is the most valuable. He should be well paid and kept up to a high state of efficiency by the constant supervision and advice of his superior.

A second inspector should be available so that changes can be repeatedly made, as one man is apt to grow stale by too long periods of duty.

(6) Diving staff. On most underwater work it is necessary to have a good diver with capable assistants and an efficient diving outfit. He must aid in getting the lower part of the site cleared and must adjust all cables, supports, braces, and loads on the molds. On a very extensive job it is well to have one of the young engineers able to put on a diving suit and go down to examine the work. This has a good influence on everybody connected with the job and helps to maintain efficiency.

The writer has learned by long and continued experience that when, on a job of underwater concrete, or any other class of concrete, a man in a responsible position becomes careless by reason of being too long on one class of work or by imagining that he knows it all, he is dangerous; the proper thing to do is either to change his work or to dismiss him instantly as an example to others.

Subaqueous or underwater concrete is as easy and as sure as any work done in the dry but it requires, as in all engineering work, care, more care, and still more care. Without that, it will fail!

"FOR EAST IS EAST AND WEST IS WEST AND NEVER THE TWAIN SHALL MEET".

(BALLAD OF EAST AND WEST)

Really, after all it is the odd, the unusual, the out of the ordinary, that makes life worth living. Unconsciously we get up in the morning and hope for it; we read our papers and look for it; we go to work on the alert for it. Once settled, however, at our daily task the chances are slim that it is going to occur, but we never get so hardened that we do not welcome it.

If our desires are met with the experience will always be pleasant, but whether or not that is the adjective to use when it comes, we live all honed up waiting for something to happen and are "sore" when it refuses to rap at our particular door. If it arrives, it marks that one day as a little different from the rest;—if it doesn't we feel that the only difference between a rut and a grave is the length.

Ye Editor of the Official Bulletin of the National Slag Association was favored the other day when some real copy for his issue walked in and, figuratively speaking, jerked him from Cleveland, Ohio, way off to Shanghai, China. This occurred when one of the representatives of the Gardner Printing Company called for copy and photographs that had been used in the making up of the issue. The representative this particular time was Mr. Kenneth Gardner, a clean-skinned, clear-eyed chap of twenty-five or six years built like a young piano mover.

The conversation for a few moments was rather snappy and to the point in regard to certain details of the copy, method of arrangement, size of cuts, etc., and then Gardner pulled something that brought the feet of the editor off his desk with a bang and started his hand towards the desk drawer that held the box of "cash customers" cigars.

It was a question that Gardner asked and it ran something as follows: "I wonder if you would be interested in learning of a section of Slag Concrete Road in Shanghai, China, that I put in something over a year ago when I was District Engineer over there?"—It came so fast and from such an unexpected angle that for a minute the editor—possessor of a fair vocabulary—searched his store of words in vain for an adequate expression that fitted the occasion and that at the same time would not indicate too emphatically that he was under the stress of strong emotion.

Yes?—How?—When?—came next, followed by enough other interrogations to produce the following story. . . .

"No need now to relate the string of incidents that sum totaled my landing pretty nearly broke in Shanghai, China, two years ago as the result of being the possessor of a wandering pair of feet,—sufficient to say that I was there and wanted to "stick around" a while. I landed a job in the City Engineering Department under Chas. H. Godfrey, City Engineer and Surveyor.

"There wasn't a great deal of incentive in the way of climate, money or surroundings to keep a chap tied to that particular city any length of time, and naturally there are a great many changes in the personnel of such an organization. To make a long story short, at the end of a year I found myself possessor of the title "District Engineer."

"Certain improvements in the ——— section of the city came under my jurisdiction and I was putting in a stretch of roadway when one of the foremen came to me one morning and asked what disposal I would suggest being made to get rid of a rather large quantity of blast furnace slag that for some purpose or other—possible a fill—had been accumulated alongside of a section of uncompleted road. I went out with him and made a "big toe" inspection and verified that by looking over a few handfuls of the material and said: 'Build this section of concrete using this material as the largest aggregate as far as it will last.'

"There is about a three hundred foot section of this particular type of concrete pavement in existence at that point as the result of my decision and after a year's use I will state in regard to the behavior of the pavement, that it was as good at the end of the year as the day it was thrown open to traffic. Don't know why this is the truth, because the material resembled in all respects the stuff in your office right now,—partially solid, partially porous,—but it is only a fool that won't face evidence when presented in the manner that this was. The stuff was not showing any visible evidence of wear at all and I imagine that when it does, it will go little faster than tempered steel."

The editor interposed here with the remark that possibly this was accounted for by the fact that there was relatively light traffic on the road, but Gardner continued—"Light nothing! It was the meanest in the world in this respect. When you get from fifty to two hundred "Chinks" armed with steel-shod wheel-barrows each loaded with weights that range from five hundred to eight-hundred pounds stringing along between two points, you get a highway punishing that has few equals if any in the world. This is accounted for by one fact—"restricted bearing area," in other words, "tracking." These coolies follow the head man and it is rarely that a wheel-barrow will vary an inch out of the original path of the leads and through some uncanny instinct, he will take the same path that he originally did on the first trip no matter if he makes hundreds of trips between the same points. The path on thus particular strip of pavement was about a foot from one side and I'll wager that out of the thousands and thousands of barrow loads that passed over the length of the road, that not fifty varied off a strip two inches wide. Nothing I ever saw stood up under such usage. Why, I watched every type and kind of pavement that I ever saw or thought of fade away into a series of deeply defined ruts within an amazingly few months, or for that matter—weeks, once it became subjected to conditions such as I have related.

"In construction work such as we were engaged in at that time, we were not hampered by rigid specifications and elaborate tests. We were expected to get results and our conscience was our guide. Frankly, I had never—previous to my own experience with the material—heard of blast furnace slag being used in any type of concrete construction, but from what I have seen of it myself and what I have since heard about it, has convinced me that it is a member of the group of highest type of aggregates produced commercially. My experience would indicate that it was the leader.

"I read copy of the proof of the original issue of the Official Bulletin of the National Slag Association and up to that time wondered if I hadn't been a "Concrete Christopher Columbus," Steve Brody, and all the other chance-takers rolled into one when I used the SLAG in that strip of concrete pavement. It was quite a jolt to find that I was only showing common sense and that my already good opinion of the material was justified to such a relatively large extent by its use in practice in the districts in the United States where it is available."

FALLING IN LOVE

This young man that I have in mind would always arrive at the office on time. He would leave on the minute at night, and during the day he would do all the things he was told to do—told to do.

No one could doubt his steadiness, but the boss did doubt his downright loyalty. One day, and all so suddenly, this young man fell in love.

Immediately things began to hum. He would come to the office earlier and leave later. His sales record began to climb, and everybody in the organization got the spirit of his enthusiasm and they all began to climb.

Within a few weeks he was advanced twice in position and pay. And all this advancement, all along the line—all this increase in business—could be traced to the young man's falling in love—in love with his work

Discussion of Article by Col. Wm. G. Atwood, '92

ENGINEERING WORK IN BASE SECTION No. 1 A.E.F.

By Wm. B. Freeman, '05

Having been stationed in Base Section No. 1, A. E. F., in the immediate vicinity of St. Nazaire, from the early part of March, 1918, to the first of June, 1919, the writer was very much interested in the able article, relative to engineering work in that Base Section, written by Col. Atwood, which appeared in the December number of The Cornell Civil Engineer. There are certain phases of the article upon which comments or criticisms might be made.

In the writer's opinion, a perusal of the article gives the general impression that most of this engineering work was done under the immediate direction of the officers and enlisted men of the 17th Engineers (Railway). Col. Atwood did not emphasize the fact that the bulk of the work was accomplished by officers and men reporting to the various Section Engineer Officers of Base Section No. 1, the first of whom was appointed in April or May, 1918. When the writer arrived in St. Nazaire a month or so before that time a comparatively small amount of construction work had actually been accomplished, though extensive plans had been prepared by the officers of the 17th Engineers, attached casual officers and officers of engineer troops attached to the 17th Engineers, under the supervision of the Director of the Division of Construction and Forestry.

The successive Section Engineer Officers were all very able men, the first two being also Commanding Officers of the 17th Engineers. But there were any number of white engineer organizations, stationed in Base Section No. 1, at various times, quite equal to the 17th Engineers in technical excellence and many that were vastly superior from the purely military standpoint. Their officers have generally resented the attitude, somewhat approaching condescension, assumed by many officers of the 17th Engineers, and their claims of achievement. A quotation from an article written by the writer several months ago, relative to the 509th Engineers, may serve to illustrate this point more fully:—"——The Battalion was sent to St. Nazaire (Mar. 10, 1918) and attached for duty to the 17th Engineers, then under the command of Col. John S. Sewell, who was shortly afterwards appointed Section Engineer Officer, Base Section No. 1, in addition to his other duties. This change of administration automatically released the various engineer units, attached to the 17th Engineers, from attached duty and placed them on the status of duty under the Section Engineer Officer, this being the status of the 509th Engineers from that time until released from duty on Apr. 30, 1919, for return to the United States.

"This distinction is brought out here because the 17th Engineers have taken the credit for the greater part of the engineering work done in Base Section No. 1, whereas most of it was actually put through by officers and men serving under the Section Engineer Officer. As a concrete illustration the writer had charge of the construction of two Mechanical Filtration Plants, both of which the 17th Engineers have since included in their list of achievements, while as a matter of fact, there was not an officer of the 17th Engineers (excepting the Section Engineer Officers) who contributed toward their completion either in design, administration or construction, and he total labor furnished by enlisted men of that organization on both jobs amounted to less than ten man-days. It is true that the 17th Engineers were the pioneers in Base Section No. 1 and it is not the intention to belittle the importance of the work performed by that organization. This is merely a protest against the attitude of all its officers to claim the lion's share of the credit and to give little or none to the units actually in charge of the various jobs."

Another subject of discussion relates to the following statement made by Col. Atwood: "The Southern negro laborer was the best workman that we had, particularly those organizations officered by Southern white men, although there appeared to be objections on this side to doing the obviously proper thing, and in some cases we had to arrange for the relief of the officers from the North who did not understand negroes, and replace them with Southerners." While the ability of Southern officers to handle negroes is freely admitted, exception is taken to the statement that Northern officers were not also successful in handling colored troups, and to the implied criticism of the policy of assigning Northern officers to such commands. There were a good many engineer officers, both from the North and the South, who fell down in the command of troops, but officers who understood the handling of men were generally quite successful. While quite familiar with the performance of other colored organizations, the writer can give more definite information about his own unit, the 509th Engineer Service Battalion, in which he was an officer throughout its existence, a period of twenty months. Most of the colored soldiers in this command came from Texas in the first colored draft and were recruited and trained at Camp Travis, all officers and noncoms being white. Of about thirty engineer officers assigned to the Battalion, during its period of service, only one was from the South and most of them had no previous experience in handling negroes. More than half of the non-coms, including three of the four 1st Sergeants, were from the North. If any colored Engineer Battalion or any colored organization of any kind in France established a better record than this Battalion, the writer would be pleased to hear about it. With an average strength of somewhat less than one thousand enlisted men the Battalion furnished 260,000 man days of labor on actual construction work during the period of thirteen months it was on assignment to duty under the Section Engineer Officer, Base Section No. 1, and most of its officers were in responsible charge of various construction features. The character of its performance was the subject of two letters of commendation from the Chief Engineer, A.E.F., while the excellent state of discipline maintained, sanitation, condition of quarters and appearance of troops were commented upon in letters and verbal expressions by Camp Commanders, Sanitary Officers and Inspectors.

AN IMPROVED FORM OF WEIR FOR GAGING IN OPEN CHANNELS

At the Spring Meeting of The American Society of Mechanical Engineers to be held May 24 to 27, 1920, in St. Louis, Mo., Mr. Clemens Herschel of New York, N. Y., will read a paper presenting the results of a series of investigations on the measurement of water by means of weirs. In his introduction Mr. Herschel says:

"*Asked by the Power Test Code Committee of The American Society of Mechanical Engineers to advise it with regard to weir measurements, and supplied by Engineering Foundation with the necessary funds to conduct the experiments, the author devised an entirely new weir which was tested in the Hydraulic Laboratory of the Massachusetts Institute of Technology. The tests revealed that for discharges of from 0 to 9.55 cu. ft. per sec. per ft. of weir length, the limits covered by the experiments, the quantity of water flowing, Q, was directly proportional to the difference, d, in two pressures, one measured just upstream of the weir, corrected automatically for the velocity of approach, and the other measured at the crest, the formula being $Q = 5.50\,d$. The weir, which bears no resemblance to the sharp-edged weir now in use, has a 2:1 slope of approach to the crest. The crest is made in the form of an acr of a circle and is hollow for observing the pressure at that point. The nappe of the stream is supported for a short distance beyond the crest by another 2:1 slope. The paper opens with a resume of the history of weir measurements and contains descriptions and diagrams of the apparatus and tests of the new weir, with tabular and graphic reports of the results obtained.*"

THE CORNELL CIVIL ENGINEER

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EDITORIALS

In This Issue

Mr. H. R. Lordly, '93, addressed the Association of Civil Engineers at their last meeting, on the subject of subaqueous concrete construction, and we are printing revised notes of his address in this issue. There is also a description by Everett E. King, Professor of Railroad Engineering in the University of Illinois, of the antiseptic treatment of timber; Professor King believes that, with the increasing cost of timber, there will be a corresponding increase in the amount of timber given preservative treatment.

In addition to these articles we have been favored with an interesting discussion of Colonel W. G. Atwood's article, "Engineering Work in Base Section No. I, A. E. F.," which we printed in our December issue. Captain William B. Freeman ,'05, of the 509th Engineers believes that Colonel Atwood gives too much credit to the 17th Engineers and too little to the other organizations working in that section.

Mr. Gordon A. Sarstedt, '15, furnished us with an interesting narative sketch of work with slag concrete in China. It is one more example of the excellent service which is being given by concrete made with blast-furnace slag for aggregate.

The C. U. C. A. on a Broader Basis

Far greater significance than is immediately apparent from the report of the amount raised attaches to the recent splendid success of the Barnes Hall Fund Campaign. To rehabilitate Barnes Hall and to provide current budget for United Christian work a fund of $22,000 was needed. The Christian Association set out to raise among the students and faculty $10,000, the amount of the current budget plus one-third of the estimated expense of the rehabilitation of Barnes Hall. The amount raised exceeded $11,000.

The unqualified success of this campaign marks a step in the establishment of the University Christian work on a broader basis of greatest service to the University. The real extent and character of this rejuvenated work can hardly be better set forth than in an article by Mr. Jared T. Newman, '75, appearing in *The Alumni News* of February 12. Mr. Newman writes:

"Three local events of the past year have interested me profoundly because of their relation to student morale. The first occurred in midwinter of last year. It was a conference of representatives of organizations interested in religious work at Cornell: Ithaca and University ministers, secretaries of denominational boards of education, directors of the C. U. C. A., and Intercollegiate secretaries of the Christian Associations. The inadequacy of anything that had been accomplished in religious work at Cornell, notwithstanding the efforts of able men from Mott to Whitehair, was recognized; the lack of coordination in the work of the city ministers with one another and with the Christian Association was faced; and a preliminary plan for the coordination of all this work under unified leadership was conceived and discussed. It was a fine example of the breaking down of sectarian barriers. Out of that meeting has grown a movement which is attracting the attention of that part of the college world which is interested in student character and ideals.

"And then came 'Dick' Edwards. The directors of the C. U. C. A. got him. They got him because they wouldn't take anything less. He was not to be had, it seemed; but they insisted upon his coming, until he felt an irresistable call. Without him, and the wisdom he has displayed in suggesting other workers, and the inspiration he has imparted to the cooperating forces, it would be another story.

"Then followed the adoption of the program. It had been agreed with the leaders of four denominational Boards of Education that Edwards, acting for the C. U. C. A., should share in the nomination of the University pastors, the nominees to be subject to the approval of the denominational leaders and elected by the Christian Association Board of Directors. Some were inclined at first to demur. But this quite-mannered descendant of Jonathan Edwards knew the value of a close-knit organization. When all the forces came face to face and recognized the spirit of the man, and that what he wanted was what they all wanted, the finest cooperation resulted. The present group of University pastors thus brought together into one united and efficient force is a remarkable achievement. Every one is a picked man of unusual attainments; and Miss Osborn, the Y. W. C. A. secretary, and Miss Peabody, the hostess of Barnes Hall, who gave up a high position after distinguished service in France to take the place here, are of like type. Altogether they made a group of nine persons in addition to the undergraduate presidents of the men's and women's organizations. Each is in charge of and responsible, with an undergraduate chairman and committee, for one particular phase of the united work.

"The second event was a luncheon at the Ithaca Hotel December 14, where President Schurman and the C. U. C. A. directors met with this cooperating group of workers. One after another of these men, together with Miss Peabody, Miss Osborn, and Buel Trowbridge, president of the C. U. C. A., told the story of what they were doing and planning in conjunction with the undergraduate leaders.

"They set forth the program of the united work in its nine main phases: 1. Voluntary Religious Study and Discussion Groups. 2. Friendship Service. 3. Hospitality at Barnes Hall. 4. Employment Service. 5. Vocational Guidance. 6. Extension Work. 7. Overseas Service. 8. Devotional Service. 9. Women's Work as Organized by the Y. W. C. A. I shall never forget the spirit that animated their remarks at that conference.

"And now we come to the third event. The work as outlined had been getting under way quietly since the beginning of the year. There had been no flourish of trumpets. The coming of this splendid force had been scarcely noticed. In the meantime its members had been quietly at work. Weekly meetings of the group kept every one in touch with all phases of development. The consecration, the tremendous interest in the one great purpose, the sinking of personal advantage in loyalty to the common cause were all manifest. But would they get the interest of the student body? Were they not aiming at too high a goal in the midst of an atmosphere where prominence in student activities seems to be the supreme end of college life, where anything religious is often tabooed among a majority of the men who set the pace, particularly in the fraternities?

"The third event has answered these questions. During the week of January 18 to 24 there was put on a campaign to raise from students and Faculty $10,000, of which $6,000 will be used 'to make Barnes Hall an open club house worthy of Cornell, a democratic center centrally located, with rooms available to any and all recognized University Organizations.' The main floor, which was so freely used by the S. A. T. C. that it suggests a barracks, is to be improved with refurnishing and new decoration. Upstairs there is to be new lighting, a new stage, movie machines and accessories. The West Dome and hallway are to be refinished. But the greatest change is on the ground floor, where the water that seeps through the walls is to be taken care of by suitable drainage and waterproof cement floors; conference and committee rooms, open to all University organizations for meetings, are to be provided; an up-to-date kitchen; and most attractive of all, in the larger dining room, 'not a cafeteria, not an ice cream parlor, not a boarding house, but a 'Cornell Coffee House,' a 'hangout' for men, attractively furnished, where real coffee, hot waffles, and the like, can be had, where Faculty and students,—you and your friends, can sit around and talk it all over.'

"The total cost of these changes will be approximately $18,000. The students were asked to provide $6,000 for this purpose. The C. U. C. A. Board believed that alumni and friends of Cornell would provide the rest if students and Faculty first showed their interest to this extent and were to provide also the $4,000 necessary for the current budget of the Association—the bare running expenses, stenographers' fees and necessary items for the various activities. So this campaign was a real test.

"Not a cent of this $10,000 was for salaries. These are provided by the cooperating churches and the alumni headed by the Cleveland group, who are doing so many splendid things, under the leadership of Joe Harris as chairman, ably seconded by C. W. Whitehair, now vice-president of the Union Commerce National Bank. If this movement were to start and grow from within the University, alumni and friends would surely be ready to do their part, remembering that unlike the older colleges, Cornell has no endowment fund for voluntary religous work and must depend upon the support of its alumni if any effective work is to be done.

"In the canvass the leaders of student activities came to the front, by speech and personal influence, in a most inspiring way. The managers of all the big teams, the captian of the football team, the editors of *The Cornell Sun*, and many others rallied to the support of the movement. The amount raised to date is over $10,000. What warms the hearts of the workers and inspires them to new devotion is not primarily what can be done with the money, but the fact that this campaign has clearly demonstrated the approval by the leading undergraduates of the methods now being pursued; and also by the Faculty, whose self-denying attitude in contributing so much as they have out of their meagre salaries is not to be forgotten.

"What does it signify? A deeper interest in religion? Yes; but that is not the outstanding feature. The average student does not know what religion is. He thinks of it as something formal, abstract, diasgreeable. He fails to connect it up with the 'abundant life'; with his own love for truth and humanity, his thought of service, his conception of a culture worth striving for both of mind and heart. The significant thing is that he now believes new forces are at work at Cornell making religion human, practical, and inspiring."

COLLEGE NOTES

President Schurman Resigns

Dr. Jacob Gould Schurman tendered his resignation as president of Cornell University to the Committee on General Administration of the Board of Trustees, which met on February 14. Dr. Schurman asked in his letter that his resignation take effect at Commencement, June 23, 1920.

The announcement that President Schurman had resigned came as a surprise except to those who are in his intimate confidence, although persons close to the President have known that he contemplated such a step for some time, and in fact, that it had been his wish to retire at the close of his twenty-fifth year of service.

In his letter to the Board of Trustees President Schurman said:

"I have long been of the opinion that it is beneficial and salutary to great institutions, whether of government or business or education, that there should be reasonably frequent changes in the office of chief executive. In conformity with this view I have for some time past had it in mind to resign the presidency of Cornell University.

"In terminating this official relation which has extended over so many years, I should do great injustice to my own feelings if I failed to acknowledge with sincere gratitude the friendly co-operation and support which I have always received in such abundant measure from trustees, teachers, alumni, and students, as well as from the staff of administration, or to assure them of the regard and affection which I cherish for them and of my best wishes fo their welfare and happiness."

At the end of the present academic year, Dr. Schurman will have completed thirty-four years of service at Cornell, six as Sage professor of philosophy amd twenth-eight as president.

Dr. Schurman was born at Freetown, Prince Edward's Island, on May 22, 1854. After studying at various colleges and universities in America, England, France, Germany and Italy he returned to Canada and spent the years 1880–1886 teaching English literature, psychology, and metaphysics at Acadia, and Dalhousie Colleges.

In 1886 he came to Cornell to fill the newly created chair of Sage professor of philosophy. In 1892, when President Adams resigned, Dr. Schurman succeeded him as President of Cornell University, and under his wise leadership, Cornell has made rapid strides ahead in many important particulars.

Cornell Spring Day in New York

Three thousand Cornellians attended the Spring Day Circus held in the Hotel Commodore, New York City, during the evening of February 23. It was the first of its kind ever held outside of Ithaca and was an overwhelming success in every respect.

To make the scene realistic, the striped tents of the Spring Day "Side Shows" were on hand and the vociferous "barkers" for the various attractions fairly outdid themselves in their harangues. Seventy-two members of the combined Cornell Masque, Savage Club, and Musical Clubs were present and rendered several numbes, all of which were well received; the "Girls' Chorus" from "My Junior Week Girl" made a special hit and received a fine write-up by the New York *Sun* and *Herald*. Davy Hoy was there with his mascot "Buster," and hot dogs ran wild all around the big ballroom. A faithful representation of Zinck's was erected in one corner with "Mart" Gibbons, "Senator" Murphy, and "Red" Lamphere in person behind the counter. The Ithaca Fire Department gave a thrilling display of the proper way to handle a fire and, to make the event complete, the "Little Lady" furnished for the occasion two publications, the "Deadly Bun" and the "Spring Lamb."

In order that the real reason for the gathering might not be lost sight of, President Schurman and Professor Orth each made eloquent addresses in behalf of the Endowment Fund. It is to be hoped that this event will be at the beginning of a series of annual reunions of a similar character in all of the large cities of the country.

Yale-Cornell Basketball Game

A sensational game was played on the Drill Hall floor on February 14th when the Varsity team beat the Yale quintet. The first half was a nip and tuck race and at the end of the period the score was tied, 9 to 9. In the second half the Varsity drew away from the Yale team and led in the scoring until the near end of the game when the score was tied. The final score was 25 to 23.

The game was attended by a crowd of more than 3,500 spectators made up of undergraduates and their Junior week guests.

West Virginia Cornell Basketball Game

The Varsity overwhelmingly defeated the veteran West Virginia five at Ithaca on February 18th by a score of 43 to 17. The entire game did not lag for want of interest as the Varsity had to fight for every point that they gained. The team showed a decided improvement over the Yale game.

Intercollegiate Aeroplane Race

Cornell will be represented in the Intercollegiate Aeroplane race on May 7 and 8 by a decision made by the Cornell Flying Club. The selection of the flyers who will compete in the race will be withheld until later in the month.

The Intercollegiate Flying Association consists of representatives from Yale, Harvard, Columbia, Princeton, Williams, and Cornell.

Boston Triangular Meet

Cornell was forced to take third place in the triangular track meet held in Boston on the night of February 28; Dartmouth captured first place with a total of 37 points, Harvard scored 31 points, while Cornell had a score of 12. All of the events were closely contested and good times were made in many of the track events; the times were especially good when the small size of the track and steep banking of the curves are considered.

The feature of the meet was the tying of the world's record in the 45-yard hurdles by Thomson of Dartmouth, who beat Smith of Cornell by about half a stride; Smith nearly caught the Dartmouth man in a wonderful sprint at the last two hurdles. Another well-contested event was the mile run in which Brown of Cornell furnished a surprise by nearly taking the event from O'Connell, Harvard's star runner and track captain. Brown took the lead from McDermott of Cornell after the first half mile and held it until the last home stretch when O'Connell passed him after a hard sprint.

Intercollege Basketball

The Civil Engineering Five has completed its schedule in the intercollege Basketball League and now occupies the coveted leading position. They went through the entire season with only one defeat and that was the first game they played when they lost to Agriculture by one point. On March 2 they won their last scheduled game when they defeated the Architects by the score of 60 to 8. Agriculture and Arts have also gone through the season thus far with only one defeat, but they meet one another in their last game which will eliminate one of them from the race; C. E. will then play the winner for the championship. Stalker, around whom the play of the C. E. five centers, leads the League in invididual scoring with a total of 68; and nearly all of his scoring has been done with field goals. We are therefore looking forward to a new championship pennant to hang in the trophy room.

Football Coach

Football prospects for a winning eleven in 1920 have brightened to a considerable extent when Gilmour Dobie affixed his signature to a Cornell contract. He comes here with a reputation for turning out winning teams that is hard to equal. He was a former coach of the University of Washington and also of the United States Naval Academy teams.

While coaching the University of Washington team for eight years he held the reputation of not losing a single game. He also produced an eleven at the United States Naval Academy last fall which defeated the Army, the Navy having been defeated five consecutive years previous to this.

Lehigh-Cornell Wrestling Meet

Cornell defeated the Lehigh wrestlers on Saturday night, February 29th, at South Bethlehem, Pa. Of the four bouts that Cornell won, two were gained on falls and the other two on decisions. The feature of the event was Conroy's exhibition. He first wrestled in the 135-pound class, because of an injury to Smoley's leg after the team left Ithaca. He threw the Lehigh man in eight minutes. After a short rest he wrestled in the 145-pound class and made a hard fight against Bertolet, the Lehigh man, but being outweighed by more than ten pounds he lost on decision. The final score was 18 to 12.

Rochester Basketball Game

The Varsity basketball team won its last non-league contest February 24th when it defeated the Rochester team by a score of 38 to 12. During the first period the game was more or less of a rough and tumble affair, many fouls being made by the opposing quintet, while Cornell was weak both on the offensive and defensive. Cornell, however, showed a complete reversal of form during the second period.

Penn State Wrestling Meet

The Cornell wrestling team was defeated by the championship Penn State team by a score of 24 to 8 in a dual meet at Penn State, February 21. The men of the Varsity found the hardest opponents of their schedule in the State College team, which is composed of Intercollegiate champions in four of the events, and contenders for championships in the other events.

Captain Ackerly and Mackey did the only scoring for the Varsity, but the remainder of the team gave good exhibitions, giving their opponents hard battles.

Baseball Meeting

On the evening of February 16, the Varsity baseball season of 1920 was formally inaugurated with an open meeting attended by about 125 candidates who listened to interesting discussions of the baseball situation by Hugh Jennings, '04, manager of the Detroit American League Club, and by Coach John P. Henry, former catcher for the Washington Americans. Jennings has coached Cornell teams before and, if possible, will visit Ithaca later in the Spring when the "Tigers" return from their southern training trip.

J. P. Henry has been selected as head coach for the 1920 baseball season and is being welcomed here with considerable enthusiasm. As a regular catcher for Washington he caught the pitching of such men as Groom, Gallia, and Walter Johnson; there he was also trained under such able leadership as Manager Griffith, the "Old Fox" of baseball. We therefore look forward to a baseball season which ought to be very successful.

"Cornell Night" in Rochester

At the invitation of the students and faculty of East High School, Rochester, the Cornell Club of Rochester presented a unique and interesting program of events in the Rochester Y. M. C. A. Auditorium. The event was one of a series arranged by Principal Albert H. Wilcox, whereby each university is alloted one night on which to call the attention of the high school students to the advantage of a college education.

The program for Cornell night included addresses by Professor E. P. Andrews, '93, R. S. Kent, '02, J. J. Munns, '14, and Lewis Henry, '09; motion pictures of Spring Day and Navy Day, and a large number of campus views. Much popular interest in the school centered around "Jimmy" Munns who was captain of Varsity football, All-American center, member of track team for three years, was elected to Phi Beta Kappa, and was chosen president of his class by unanimous election.

Other alumni organizations would do well to investigate this example of the Rochester Cornell Club, and plan similar activities for their own cities.

ALUMNI NOTES

'75. O. W. Ferguson has changed his address to 724 G Street, N. E. Washington, D. C.

'84 C. E., '89 M.C.E. W. L. Webb of 31 Runnymede Ave., Lansdowne, Pa., has returned from France as a Major in the U. S. A. Engineers and is now Chief Engineer in Renting, Requisitions and Claims Service.

'86. Charles B. Wing is now Professor of Structural Engineering at Stanford University, California.

'92. J. C. L. Fish, Professor of Railroad Engineering at Stanford University, informs us that Wm. G. Atwood, '92, is Technical Advisor to the Kingdom of the Serbs, Croats and Slovenes with headquarters at 115 Broadway, New York City.

'93. H. K. Bishop has accepted the position of State Highway Engineer of Indiana. An article in the *Highway Magazine* declares that the State of Indiana is to be congratulated upon securing the services of Mr. Bishop and that the good roads enthusiasts are rejoicing over the news.

'95. Clarence E. Boesch has returned from the service and is associated with Gilbert C. White as chief engineer on design and construction work at Durham, N. C.

'95. John Weatherson has been appointed an Associate Professor of Medicine in the University of Illinois. His address is 5758 Grand Boulevard, Chicago, Ill.

'96. Frank S. Senior, lately a Major in the Transportation Forces of the A. E. F., is at present vice-president of the Arthur McMullen Co., 149 Broadway, New York City.

'97. J. C. Hoyt and Carleton Greene, '91, were elected directors of the American Society of Civil Engineers. J. C. Hoyt is with the U. S. Geological Survey, at Washington, D. C.

'99. M. S. Darrow is Manager for the Barber Ashpalt Paving Company, Madison, Illinois and can always be reached at this address.

'99. Charles C. More is a Professor at the University of Washington, Seattle, Washington.

'00. J. H. Miner is with D. P. Robinson & Co., Constructing and Consulting Engineers, Room 2018, 61 Broadway, New York City.

'00. John Cresson Trautwine, 3d, now resides at 1108 S. 46th St., Philadelphia, Pa. He is now occupied as a miscellaneous expert and in consulting work for short periods.

'01. Arthur Adams is Vice-President of Adams, Evans and Company. He is engaged in general engineering and contracting business and resides at 1022 Bedford Ave., Brooklyn, N. Y.

'01. R. F. Proctor is now Chief Engineer for the Maryland Casualty Company of Baltimore, Md.

'03. N. A. Brown has been elected Vice-President, Engineers Post, American Legion, at Rochester, N. Y.

'03. L. S. Hubbard has changed his address to 50 Triangle Bldg., Rochester, N. Y.

'03. A. R. Keller can be located at the Pleasanton Hotel, Honolulu, T. H. He tells us that J. Dickson Pratt, '14, returned to Honolulu and is Assistant Director of Census, also that H. A. R. Austin, '16, is Assistant Engineer in the office of City and County Engineer.

'04. Clifford M. King is now Senior Assistant Engineer in the Division of Sewage Disposal for the City of Cleveland. His residence is Masonic Temple, Sandusky, Ohio.

'05. William B. Freeman has lately been discharged from the army as Major in the Engineers and is now Branch Manager of the Lock Joint Pipe Co., 500 Railroad Building, Denver, Colo.

'05 A.B., '06 C.E. Frederick W. Scheidenhelm, of the firm of Danie, W. Mead and F. W. Scheidenhelm, Consulting Hydraulic Engineersl whose offices are at 120 Broadway, New York City, resides at 10944 Hilburn St., Hollis, New York.

'06. Percy L. Braunworth is Industrial Engineer for Braunworth & Co., 80 Broadway, Brooklyn, N. Y. He was recently honorably discharged from the Engineers Corps.

'06. Grover C. Brown is Assistant Chief Engineer for the Cambria Steel Company at Johnstown, Pa. His address is 61 Venango Street.

'06. Arch M. Snow is now with the N. Y. State Highway Department and is located at Malone, N. Y. His address is 44 Elm Street, Malone, N. Y.

'07. W. E. Darrow has returned to his position as Assistant Engineer, New York State Highway Department, with headquarters at Utica, N. Y., after having served as Captain in the A. E. F.

'07. Burtis J. Finch has been appointed District Engineer for District No. 12 of the Bureau of Public Roads. He is supervising Federal Aid Roads for Utah and Nevada with headquarters at Ogden, Utah.

'08. Albert B. Cudebec is European Manager for the Ohio Brass Company of Mansfield, Ohio. His address is American Express Co., Rue Scribe, Paris.

'08. H. M. Nelson has given us his temporary address as Massena, N. Y. His home address is East Ryegate, Vermont.

'08. William E. Spragins of Salt Lake City, Utah, is Manager of Spragins and Company of that place.

'08. John H. Stevens is with the Watertown Division of the New York State Highway Department as Assistant Engineer. His home address is Rome, N. Y.

'09. J. R. Hawsell is Drainage Engineer at the Pennsylvania State College. His address is 402 Delaware Avenue. Wilmington, Del.

'09. D. O. Stone of the State Highway Department, Columbus, Ohio, informs us that G. R. B. Symonds, '09, has been appointed City Engineer of Nutley, N. J.

'09. G. R. B. Symonds has changed his address from Holley, N. Y. to Nutley, N. J., where he is City Engineer.

'10. George P. Donnellan is an Engineer with the Brazos River Oil Corporation, at Shreveport, La. He lives at 520½ Spring Street, Shreveport, La.

'10. Lawrence Griffin is an Industrial Engineer for the Jones and Laughlin Steel Company of Woodlawn, Pa. His business address is 148 Taylor Ave., Beaver, Pa.

'10. T. S. Hauck is an Assistant Engineer with the International Rapid Transit Company, engaged in subway and "L" construction in New York City. His address is 2225 Eutaw Place, Baltimore, Md.

'10. F. S. Hopkins is Assistant Engineer for the Board of Public Works of Poughkeepsie, N. Y. His address is 50 South Clinton Street, Poughkeepsie, N. Y.

'10. Harold H. Jones, whose home address is 96 Norwood Avenue, Buffalo, N. Y., is now his own employer, as he says, acting in the capacity of Secretary and Treasurer of the Lapan :Logging Company located at Jackson Bay, B. C.

'10. H. D. Kneeland is in charge of the production department of the United Engineering -and Foundry Company. His address is 5879 Darlington Road, Pittsburgh, Pa.

'10. E. H. Leggett is now in the employ of the Ludlum Steel Company at Watervliet, N. Y. His address is 8 S. Allen Street, Albany, N. Y.

'10. Bernard J. O'Rourke is a member of the firm of O'Rourke Brothers, Engineers and Contractors, located at 430 Walnut Street, Philadelphia, Pa.

'10. Gilbert V. Steele is back with the Corrugated Bar Company in New York City. He is residing at 245 State Street, Flushing, N. Y.

'10. Roy Taylor, who was awarded the Legion d'Honneur by Marshall Petain in April, 1919, is now in the employ of the Munson Steamship Line. He lives at 455 Greene Ave., Brooklyn, N. Y.

'10. Edgar Whedbee has changed his address to 601 West 10th Street, Bonham, Texas, where he is a Consulting and City Engineer engaged largely in construction work.

'11. A. G. F. Buehler is now a Patent Attorney in the employ of J. F. Norris. His address is Apt. 121, The Portner, 15th and U Sts., N. W., Washington, D. C.

'11. R. S. Crossman is Assistant Professor of Civil Engineering at Clemson College, Clemson College, S. C.

'11. N. R. Finkelstein has changed his address to 157 West 79th St., New York City.

'11. Rafael Gonzalez of 35 San Sebastian St., San Juan, Porto Rico, is now in private practice, specializing on Building Construction.

'11. Harvey S. Johnson is Assistant Engineer for the Bossert Corporation at Utica, N. Y. His address is 1408 Oneida Street, Utica, N. Y.

'11. N. L. MacLeod is with the Ayer and Lord Tie Company at Chicago, Ill. His address is 4947 Kimbark Ave., Chicago, Ill.

'11. C. E., '12 M.C.E. H. A. Vanderbeck, Dean of the College of Civil Engineering at the Government Institute of Technology, Shanghai, China, is now taking a one year leave of absence and can be addressed at 64 West Main Street, Somerville, N. J.

'11. Howard S. Warner, recently a captain with the 315th Engineers is at present in the oil business throughout Texas and Louisiana. His home address is Vicksburg, Miss.

'12. W. C. Conger is with the Truscon Steel Company of Youngstown, Ohio. Mail may be addressed to him in care of the Company.

'12. W. G. Distler is with the G. A. Fuller Co. at Baltimore, Md. He lives at 2905 N. Calvert St., Baltimore, Md.

'12. Rowland R. Graham is a Designer and Estimator for the American Bridge Company of 30 Church Street, New York City. His home address is 217 McLean Ave., Yonkers, N. Y.

'12. Lee C. Mahoney of 2886 West 15th St., Los Angeles, Cal., is Assistant Engineer with the firm of Barrett & Hilp in San Francisco. His business address is 1011 Bush St., San Francisco, Cal.

'12. H. A. Powell is now a Sales Engineer at Birmingham, Ala. his address is 1403 So. 21st Street, Birmingham, Ala.

'12. Calvin L. Wilson is Auditor for the Acme Brick Company of Fort Worth, Texas. He is residing at 1222 Jennings Ave., Fort Worth, Texas.

'13. Wallace D. DuPre is Manager of the Ford Agency of E. F. Bell in Spartanburg, S. C.; his home address is 233 North Church Street.

'13. Henry Ten Hagen is Assistant Engineer in the N. Y. State Highway Commission. He is located at Warsaw, N. Y., where he is in charge of maintenance and construction of highways in Wyoming County.

'13. Charles R. Johnson has changed his address to 2902 St. Paul Street, Baltimore, Maryland. At present he is Lieutenant C. E. C. located at the Sumarine Base, New London, Conn.

'13. R. T. Kerby is with the American Telephone and Telegraph Company. His address is 1019 Kenmore Place, Brooklyn, N. Y.

'13. Don Lee, whose home is in San Angelo, Texas, has a position as Sales Engineer with the Lakewood Engineering Co., located in 711 Sumpter Bldg., Dallas, Texas.

ex '13. William R. Masuon is Assistant Engineer and Superintendent for E. V. Johnson Company on construction work. He is residing at 5228 South Park Ave., Chicago, Ill.

'13. G. Miller is connected with the Drummond-Miller Company of Cleveland. He lives at 9400 Euclid Ave., Cleveland, Ohio.

'13. Carl Rohwer now is Junior Engineer with the Irrigation Section of the U. S. Department of Agriculture located at Fort Collins, Colo.

'13. Hardin D. Thweatt is now employed with the Van Dorn & Dutton Company of Cleveland, Ohio, as Assistant Superintendent. He resides at 2020 E. 90th Street in the above city.

'13. Theodore L. Wells, Jr., of 1931 East 79th Street is Superintendent of Construction with the Crowell and Little Construction Co. at Cleveland, Ohio.

'14. J. S. Bailey is Division Engineer for the Portland Cement Association of Atlanta, Ga. His address is 614 Madison Ave., Montgomery, Ala.

'14. Albert M. Bowles is Vice-President and General Manager of the Texas Concrete Construction Company. He is living at 305 Arondale Ave., Houston, Texas.

'14. George A. Chase, Jr., is at present the Manager of the Claim Department of the Home Friendly Insurance Co. His business address is 1026 Linden Ave., Baltimore, Md.

'14. Arthur M. Field is partner in the firm of Hopkins & Field, Consulting Engineers, at Rochester, N. Y. He lives at 25 Argyle St., Rochester, N. Y.

'14. Joseph A. W. Iglehart was recently made a member of the firm of Brooke, Stokes & Co., 102 St. Paul St., Baltimore, Md., of which he has been Sales Manager since his having returned from service.

'14. Emoty W. Lane is now a Special Agent for the U. S. Census, collecting information on the drainage of the Southern Mississippi Valley His home address is 1038 Heath Street, Lafayette ,Ind.

'14. N. C. McMath is Manager of the Canadian Branch of the Buhl Stamping Company, at Walkerville, Ont. His address is 215 Iroquois Ave., Detroit, Mich.

'14. A. D. Newkirk is with the Isham Randolph Company, and is Chief of Party making a drainage survey of the upper St. Johns Drainage District in Florida. His address is 415 E. 3d St., Jacksonville, Fla.

'14. Edmond U. Ragland whose home is at 228 W. Fisher St., Salisbury, N. C. is Engineer for P. S. Campbell on general engineering work. He is residing at 1104 Scott St., Wichita Falls, Texas.

'14. Alfred M. Randolph has recently been discharged from the Army and is again with the Bartlett Hayward Company of Baltimore, Md., as Assistant Superintendent of Construction Work, His home is at 8 East Preston Street, in that city.

'14. W. M. Reck is District Engineer with the Concrete Steel Company at Syracuse, N. Y. His address is 416 54th Steret, Brooklyn, N. Y.

'15. Leon Blog is in the Efficiency Department of the Goodyear Tire and Rubber Company at Akron, Ohio. His address is 1355 Goodyear Ave., Akron, Ohio.

'15. Robert L. Glose, of 447 S. Rebecca Street, E. E., Pittsburgh, Pennsylvania, is Secretary and Treasurer of the National Steel Fabric Company of the same city.

'15. C. K. Kerby is Block Engineer with the N. Y. Telephone Company in New York City. He lives at 40 Rugby Road, Brooklyn, N. Y.

'15. Charles A. Mengers can be reached at 2106 Lancaster Ave., Wilmington, Del., where he is designing for the DuPont Engineering Company.

'15. Herbert Ridgway is with the American Bridge Company of New York. His address is 819 Haddon Ave., Camden, N. J.

'15. James R. Rosenfeld is engaged in the life insurance business as a Salesman. He is living at 5621 Northumberland Ave., Pittsburgh, Pa.

'15. Thomas M. Stuart is Industrial Engineer for the Tolhurst Machine Works of Troy, N. Y. He is residing at 292 Summer Ave., Springfield, Mass.

'15. Charles B. Watkins was married Oct. 21, 1919, to Miss Gertrude M. Cooper, of Greenfield, Indiana. Miss Cooper received an A.B. degree in 1914 from Earlham College, Richmond, Indiana, Watkins is Lieutenant in the Corps of Civil Engineers, U. S. Navy Yard, stationed at Hampton Roads, Va. He lives at 1021 Brandon Ave., Norfolk, Va.

'15. Alan F. Williams has headquarters at Williams, Arizona. He is in the employ of the A. T. & S. F. Ry. Co. in the position of Transitman.

'16. Harold L. Bache is with the Southern Products Company at Dallas, Texas.

'16. Henry A. Foster of 205 Garfield Place, South Orange, N. J., is a Structural Designer with D. P. Robinson & Co., New York City.

'16. Charles Pearsall Frost's permanent address is 253 Church St., Poughkeepsie, New York, although any communications will reach him if addressed care Carson Construction Company of Gordon, Georgia. He now holds the position of Field Engineer with the above concern.

'16. Felix Stanton Hales of 1907 Belmar Road, Cleveland, Ohio is Assistant Corporation Engineer for the N. Y. C. and St. L. R. R. Co. He has been elected a member of the American Association of Engineers.

'16. Albert P. Himes is Assistant Engineer on Valuation work with the N. Y. C. and St. L. R. R. Co. He is living at 13424 Emily St., East Cleveland, Ohio.

'16. S. E. Hunkin, the originator of the first bear mascot of Cornell Touchdown 1, is Superintendent of the Hunkin-Conkey Company of Cleveland, Ohio. He lives at 15907 Lake Ave., Cleveland, O.

'16. Mr. Rowland K. Bennett of Philadelphia, N. Y., is now employed by the McHarg-Barton Co., on quay wall and dock construction in the Navy Yard at Washington, D. C.

'16. Paul King is an Engineer and Surveyor with the Atlantic Coast Realty Company at Petersburg, Va.

'16. Herman C. Loeffler, of Glendale, Long Island, is now in the Bureau of Municipal Research, taking a City Manager Course.

'16. Wayne Mac Veagh has accepted a position in the Engineering Department of the Valley Mould and Iron Corporation, Sharpsville, Pa.

'16. Kenneth P. Moore is Assistant to Engineer of Grounds and Buildings at the Sprague Electric Works, Bloomfield, N. J.

'16. A. F. Perry, Jr., has changed his address to 2048 5th Street, Port Arthur, Texas.

'16. Lawrence T. Reinicker is Designing Engineer for the Baltimore City Water Department. His home address is 3310 Harford Ave., Baltimore, Md.

'16. M. P. Shelley is Assistant Engineer, engaged in the construction of the 40th Street Bridge in Pittsburgh. His address is 802 Century Building, Pittsburgh, Pa.

'16. George P. Spear, Jr. is with the New York Telephone Co., 203 Broadway, New York, N. Y., as Building Inspector. He lives at 242 Gregory Ave., Passaic, N. J.

'16. C. H. Walker is President of the Walker Equipment and Supply Company of Baltimore. His address is Apt. 54, Cathedral Apartments, Baltimore, Md.

'17. Joseph P. Blundon of Riverdale, Maryland is County Engineer for Boone County in West Virginia. He gives his temporary address as Madison, W. Va.

'17. Chauncey M. Briggs is now Assistant Engineer for the Sinclair Refining Co. He is in charge of Water Supply, Sewage Disposal and Acid Plants. His address is 6530 Yale Ave., Chicago, Ill.

'17. Edward Cummings is Service Representative of the Ward Motor Vehicle Company at Mt. Vernon, N. Y. He lives at 2877 Briggs Ave., Mt. Vernon, N. Y.

'17. Bernard C. Dailey is a First Lieutenant in the Coast Artillery service of the U. S. Army. He has been assigned to command the 17th company, coast defense of Manila and Subig Bay. He can be addressed at Fort Mills, Corregidor, Manila, Philippine Islands.

'17. W. R. Dillard is an Engineer for the Converse Bridge and Steel Company at Chattanooga, Tenn.

'17. J. H. Gray who is with the White Construction Company is now living at 1039 North Broad Street, Elizabeth, N. J.

'17. John J. Gromfine is with Lockwood, Greene and Company of 245 Fillmore Ave., Boston, Mass., engaged in designing.

'17. R. T. Guilbert is a salesman for the Sun Company of New York City. He lives at 536 W. 113th Street, New York City.

'17. Charles A. Hoffman resides at 1352 Perkiomen Avenue, Reading, Pa., and is employed as Assistant Adv. and Sales Pro. Mgr. with the Vanity Silk Mills of that city.

'17 M.C.E. K. Lee has recently returned to China. His address is care Lee Hong Fong Co., Northern St., Nansiang, Kiangsu, China.

'17. W. W. Lehrbach is with the McGraw-Hill Company, Inc., of New York City representing their engineering publications in New England, on editorial, advertising, and circulation work. He informs us that T. H. Prentice, '17, is Engineer for the Lockwood Greene Company, Engineers and Architects. located at Hartford, Conn., on new construction work. W. W. Lehrbach's home address is 363 Dearborn Street, Buffalo, N. Y.

'17. Donald A. Mackenzie will now be found at 623 Walnut Avenue, Niagara Falls, New York, where he is employed with the U. S. Aluminum Co.

'17. Harold G. Miller is Service Manager for the Vanity Fair Silk Mills at Reading, Pa.

'17. Cushing Phillips is Junior Assistant Engineer with the New York State Highway Department. His address is 1150 84th St., Brooklyn, N. Y.

'17. J. A. Piersol is Junior Assistant Engineer for the Sanitary district of Chicago. His address is 612 Meadow Ave., Charleroi, Pa.

'17. Oscar F. Priester is a partner in the Priester Construction Co., at Davenport, Iowa, 304 Putnam Building.

'17. L. P. Raynor is with the U. S. C. G. S. at Manila, P. I.

'17. William B. Schekel is supervising construction and design with Adams, Evans & Co., at 30 Church Street, New York City. His home address is 943 St. John's Place, Brooklyn, N. Y.

'17. Roy J. Zander now lives at 2014 Sheffield Ave., Chicago, Ill. The first of this year he became a member of the firm of Zander-Reum Company, Contractors of the same city.

ex '18. Horace G. Benedict is salesman for the Eastern Steel Company with offices at 60 Broadway, New York City.

'18. J. W. Fitzgerald is auditor in the Village of Clayton, N. Y.

ex '18. W. C. Jaeger is Resident Engineer for the Boone County Highway Department at Madison, West Virginia.

'18. Maxwell Kurcias is Civil and Refrigerating Engineer in New York City. He lives at 63 E. 177 St., New York City.

'18. A. F. Stolz is with the Merchants Life and Casualty Company at Minneapolis, Minn. His address is 500 Wilmac Building.

'18. Richard E. Weber is a Transitman for the New York State Railways engaged in electric railway surveys. He can be addressed at 267 State Street, Rochester, N. Y.

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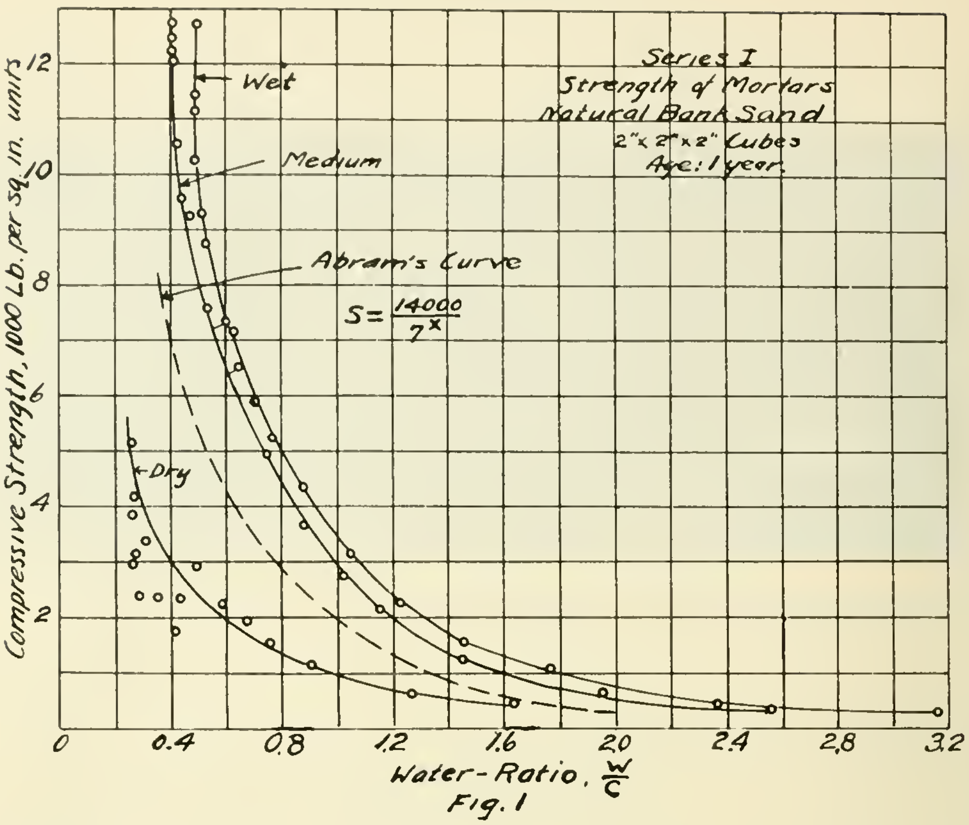

Fig. 1

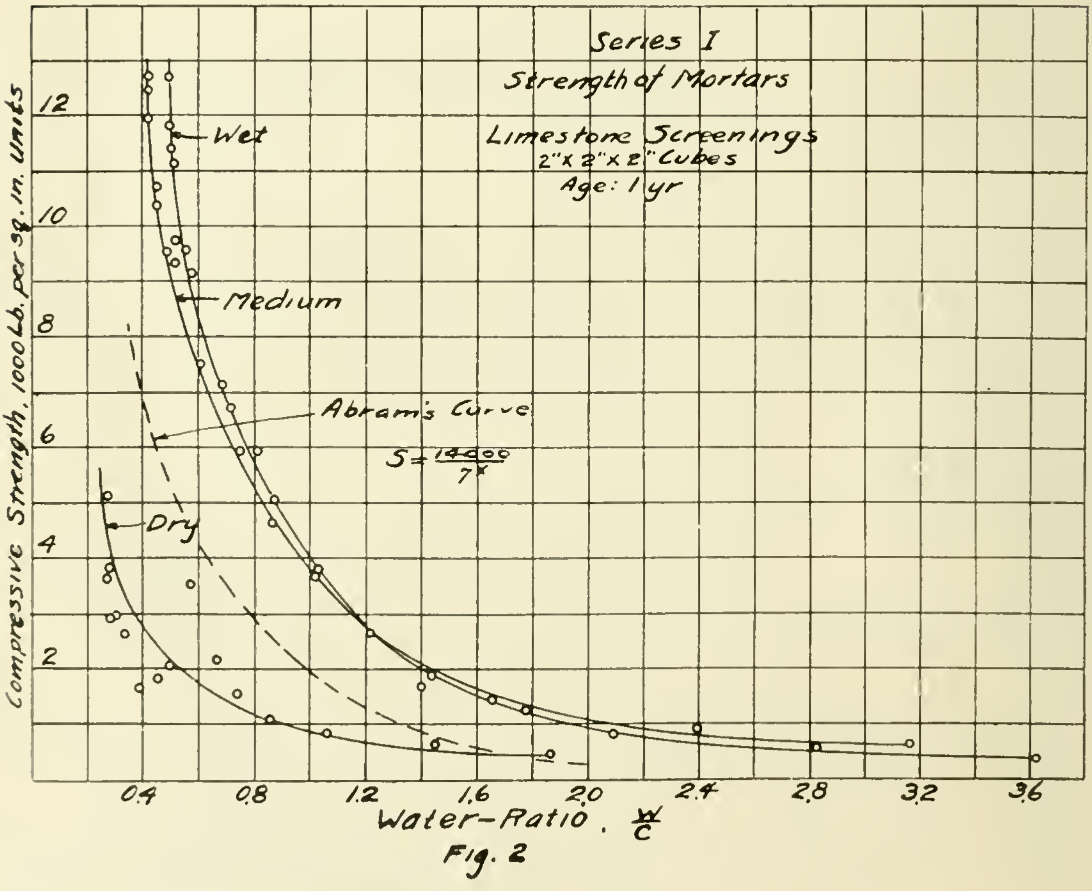

Fig. 2

EFFECT OF WATER-RATIO ON STRENGTH OF CONCRETE

THE CORNELL CIVIL ENGINEER
and
Transactions of the Association of Civil Engineers
of Cornell University

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TWO RECENT METHODS FOR PROPORTIONING CONCRETE

By H. H. Scofield, '05

Since the beginning of modern use of concrete the method of proportioning has in the main been one of arbitrary selection. Later, and more especially in comparatively recent years, more attention has been given to the development of rational practical methods of determining the correct proportions by a systematic study of the materials used and the conditions involved in the manufacture of the concrete.

The first of these has been the method of arriving at quantities by determining the voids in the aggregates. This method can be, and is, rationally used to some extent at the present time. Some of the objections to its use are important, such as the practical difficulties of accurately measuring voids, the many conditions as moisture, settlement of aggregate, compactness, etc., which affect the voids, and the knowledge that after all it is not the voids in the aggregate which determines the quality of the concrete as much as it is the lack of voids or "density" in the mortar or concrete produced.

The "density" theory of proportioning concrete is based upon the idea that just two fundamental factors determine the strength of concrete. One is the actual volume of hard particles in the mass ("density"), and the other is the extent to which they are glued or cemented together. The well known "parabolic" relation of cement and aggregate sizes, first reported by Fuller and Thompson in Trans. Am. Soc. C.E. Vol. 59, is founded upon the principle of producing workable concrete of "maximum density." The writer has never seen results of tests of concrete which disprove the fact that concrete of maximum density is also of the greatest strength for any given proportion of cement. However, density determinations are laborious and impractical. The range in "densities" for commercial mortars and concretes is small so that careful and accurate methods must be employed to obtain usable results.

In the desire for a practical, usable and rapid method of proportioning concrete, and one which would also be founded upon correct principles, there have recently been reported two methods of somewhat unique characteristics. The first of these is the "fineness modulus" method of designing concrete mixtures[1]; the second is the surface area method of design.[2]

In the former method, which is founded upon the results of a large number of tests, emphasis is placed on the fact that the quantity of water in the concrete is the controlling factor and that, therefore, the problem of designing concrete mixtures resolves itself into one of determining methods of producing a workable concrete with a minimum quantity of cement and a given water-ratio (ratio of volume of water to volume of cement assuming cement to weigh 94 pounds per cubic foot). "The methods which secure the best grading of aggregates and the use of the driest workable concrete, are thus seen to be only devices which enable us to accomplish the above mentioned results." The amount of water to be used is made a function of the normal consistency of the cement and the "fineness modulus" of the aggregate.

The fineness modulus furnishes a method of measuring the size and grading of aggregates. For standardization and uniformity the Tyler standard sieves are used, in which each sieve has a clear opening just double that of the preceding one. The fineness modulus is the sum of the percentages of material coarser than the various given sieves, divided by 100.

The surface area method is based upon the fact that the amount of cement and water required to produce a concrete of a given strength, is a function of the total surface area of all the particles of aggregate. The amount of water to be used is made a function of the normal consistency of the cement and the surface area of the aggregate. The problem then is to first determine the sieve analysis of the aggregate and, by means of tables or diagrams giving the surface areas of different sizes, to proportion the weight of cement per desired surface area of aggregate. Sand and gravel particles are assumed to be spherical in shape, and crushed aggregates to be partly cubical and partly parallelepipedal.

The writer has recently finished some tests of cement mortars of various kinds made up about two years ago in the Laboratory for Test-

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[1] Design of Concrete Mixtures by Duff A. Abrams. Bulletin No. 1 Structural Materials Research Laboratory, Lewis Institute, Chicago.

[2] "Proportioning the Materials of Mortars and Concretes by the Surface Areas of Aggregates" by L. N. Edwards, Ottawa, Can., Proc. Amer. Soc. for Testing Materials, 1918.

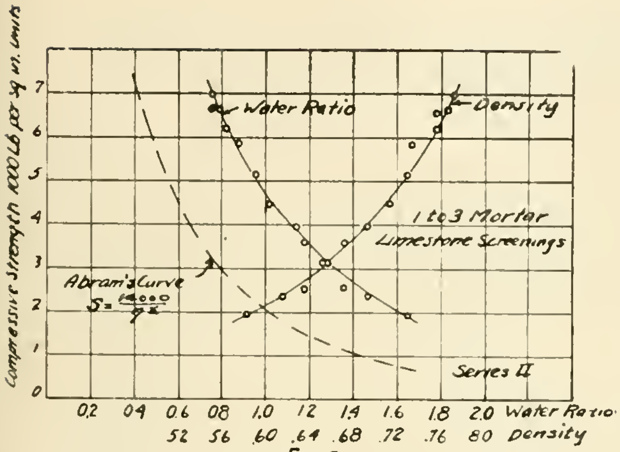

Fig. 3

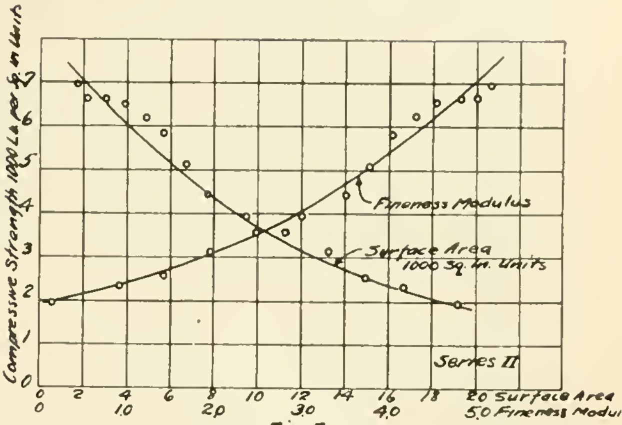

Fig. 5

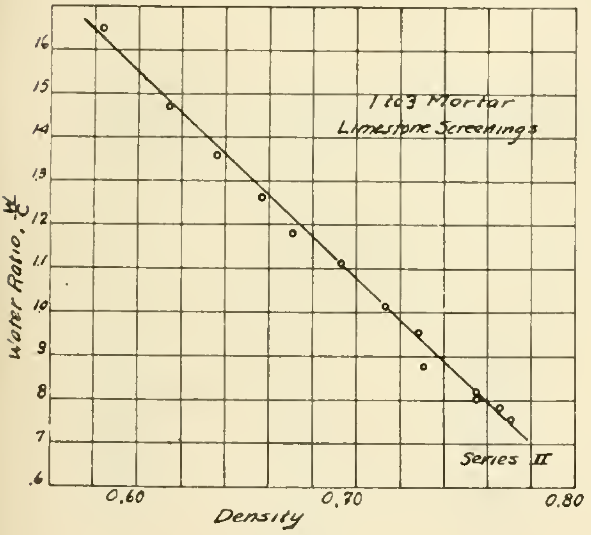

Fig. 4

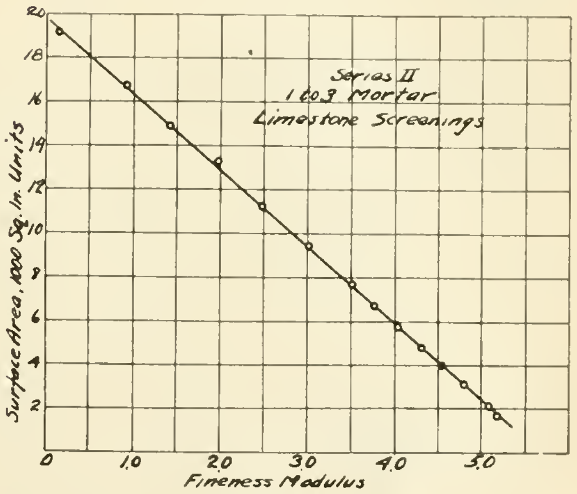

Fig. 6

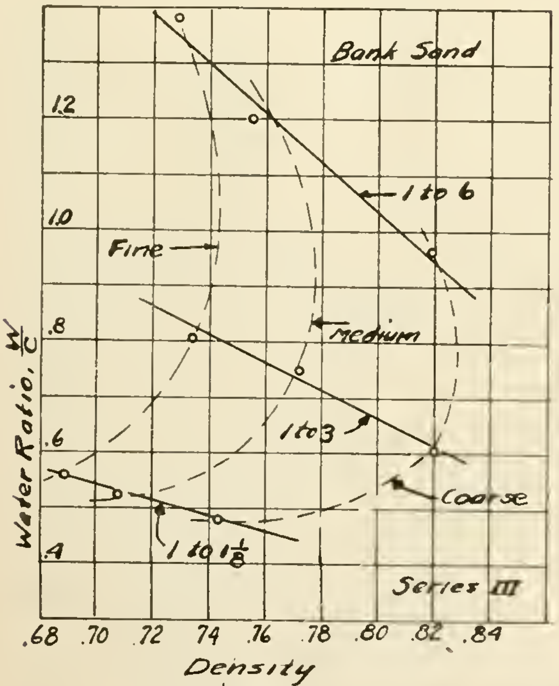

Fig. 7

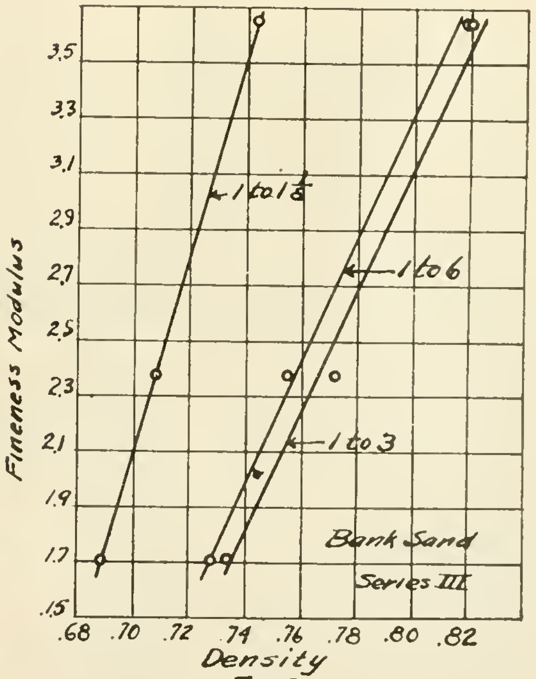

Fig. 8

ing Materials, Purdue University. For purposes of additional information and illustration, certain characteristics of these tests are here given which are entirely apart from the purposes of the tests when they were started.

The three series of tests are as follows:

Series I—Strength of Mortars of sand and limestone screenings with varying proportions of cement, and at three degrees of wetness or consistency. The sand and screenings were of the same sieve analysis, as follows:

Size	Per cent by weight	Size	Per cent by weight
0–100 mesh	2.0	0–20 mesh	40.0
0– 80 "	4.0	0–16 "	50.0
0– 40 "	20.0	0– 8 "	72.0
0– 30 "	35.0	0– 4 "	100.0

Series II—Determination of the effect of fine dust in limestone screenings. (Dust is considered as particles smaller than a No. 100 mesh sieve).

A partial sieve analysis of the different mixtures is as follows:

	PER CENT BY WEIGHT COARSER THAN THE FOLLOWING SIEVES				
Batch No.	100	30	20	8	4
1	0.0	0.0	0.0	0.0	0.0
2	15.0	14.0	13.2	9.7	0.0
3	25.0	23.3	22.1	1.0	0.0
4	35.0	32.8	31.1	22.4	0.0
5	45.0	42.0	39.8	29.0	0.0
6	55.0	51.2	48.6	35.1	0.0
7	65.0	60.7	57.5	41.8	0.0
8	70.0	65.3	61.9	44.9	0.0
9	75.0	70.0	66.3	48.1	0.0
10	80.0	74.8	70.8	51.7	0.0
11	85.0	79.2	75.0	54.7	0.0
12	90.0	84.0	79.5	58.0	0.0
13	95.0	88.7	84.0	61.0	0.0
14	97.5	91.0	86.3	62.8	0.0

Series III—A study of the relation between "density" and strength, using three differently graded sands and screenings in a rich, a medium, and a lean mortar.

The proportions used were 1 to 1⅛, 1 to 3, and 1 to 6 by weight. The different gradings were as follows:

	PER CENT BY WEIGHT		
Size	Fine	Medium	Coarse (uniformly graded)
0–100 mesh[3]	9.0	5.0	2.2
0– 30 "	55.0	35.0	8.8
0– 16 "	75.0	50.0	16.8
0– 8 "	90.0	72.0	37.0
0– 4 "	100.0	100.0	100.0

Series No. I Figures 1 and 2, serves as a means of studying the strength of concrete in connection with the "water-cement ratio". It should be noted that when these test specimens were made no attention was paid to water-ratio as such, but extreme care was taken to make all mortars in the same class of the same degree of wetness or consistency, as judged by the eye. The concordance in form with Abram's curve is to be noted. In the case of the writer's results, the variation in water-ratio is caused entirely by varying the amount of cement, the aggregate being constant in all cases.

Series II, Fig. 3, affords a means of illustrating the changes in water-ratio by keeping the amount of cement constant and varying the sizes of the aggregate. In this case the change is effected by varying the amount of material finer than a No. 100 mesh sieve. The concordance in form with Abram's curve is here also to be noted. It should be stated that the constants, in the equation for strength and water-ratio curves, are variable for different conditions of cement quality, age, curing conditions, etc. Figs. 3 and 4, also, show the variation of strength with density and that, for the conditions of this series, there is a straight-line relation between water-ratio and density. Figs. 5 and 6 show that, for this series, both the fineness modulus and the surface area methods are fairly accurately indicative of the compressive strength and that they also bear a straight-line relation to each other.

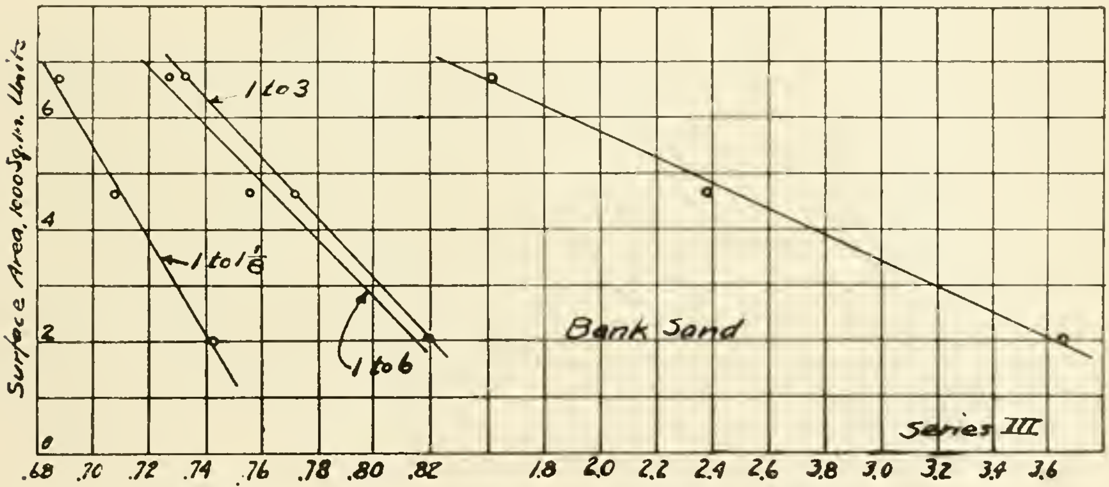

Fig. 9

Series III illustrates a change in water-ratio as effected both by a changed in the amount of cement, and by a change in the gradation of the aggregate. Here again water-ratio and density seem to bear a straight line relation to each other for the same proportion of cement. Figs. 8 and 9, for this series, seem to indicate a fixed relation between fineness modulus and density, surface area and density, and also between fineness modulus and surface area. The strength tests of this series have not as yet been made.

The results of the foregoing tests, while not at all conclusive on account of their non-comprehensiveness, are nevertheless somewhat indicative of a relation existing between fineness modulus and surface area, and also of a relation between each of these and the "density" of the concrete produced. It might also seem that the very definite effect of the water content on the strength of mortars and concretes, is not on account of the presence of the water itself as much as on account of the changes in the density of the mass caused by the presence of the water. The writer is at present engaged in studying the properties of mortars and concretes in the commercial range of consistencies and gradings, to see if such relations do not exist.

Bo h methods of proportioning are to be commended in several important points. Both very definitely fix the amount of water to be used for the best results with the cement and aggregates at hand. Both involve the use of a screen analysis of the aggregate,—a determination which is simple, accurate and practical. The standard set of sieves used in the fineness modulus method would seem to be a step in the right direction toward the development of a uniform specification for aggregates and the methods of combining them. Both methods would promote the use of a greater variety of our natural materials than do our present specifications.

STRENGTHS OF STEEL BULLETIN

"The Relation between the Elastic Strengths of Steel in Tension, Compression, and Shear," by F. B. Seely, Associate Professor of Theoretical and Applied Mechanics, and W. J. Putnam, Associate of Theoretical and Applied Mechanics, has been issued as Bulletin No. 115 of the Engineering Experiment Station of the University of Illinois.

This bulletin presents the results of experiments with six grades of steel, three carbon steels and three alloy steels; namely, soft, mild, and medium carbon steel; and vanadium, nickel, and chrome-nickel alloy steel. The elastic strength in tension, in compression, and in shear is given for each of the six grades of steel.

Copies of Bulletin No. 115 may be obtained without charge by addressing C. R. Richards, Director, Engineering Experiment Station, University of Illinois, Urbana.

STEEL REPLACING WOOD FOR FORMWORK

By C. B. Hopkins, C.E. '07
Assoc. Mem. Am. Soc. C.E.

Up until two or three years ago a history of the advancement of reinforced concrete would show but slight improvement in the construction of formwork. Recently, however, such wonderful strides have been made in the design of reinforced concrete that it has no equal for fireproof construction. Decided improvements have been made in the manufacture of Portland cement; much study has been given to the mixture of cement with its aggregates; numerous new types of reinforcing bars introduced; new systems or types of design involving either different methods of calculating stresses or a different arrangement of slabs, beams and columns adopted. All have served their purpose in bringing reinforced concrete building work to perfection.

The type of centering or formwork, however, has been sadly neglected, and this in the face of the fact that the cost of formwork is more than one-third of the total cost of the concrete work in buildings. It would seem that this fact alone would have brought about an early study of the possibilities of economy in formwork. The enormous waste in timber for formwork has also been a subject of discussion of increasing interest although, until lately, but little has been done to prevent this waste.

Ordinarily in building construction the smaller sizes of lumber will not average over two uses and to obtain an average above this better grades of timber must be used and costly precautions taken in erecting. Under the most favorable circumstances it is impossible to obtain more than four or five satisfactory uses out of one and two inch form lumber. With the price of lumber quadrupled in the past four years and with the source of supply continually decreasing it is evident that either some method must be devised whereby timber formwork can be constructed so as to decrease the amount of waste, or some new material such as steel in standard shapes and sizes must be brought into common use.

Steel forms have been used for some years in the construction of concrete pipe, tunnels, sewers and curbs. This was brought about more because of the circular nature of the structure, which practically prohibited the use of wood on account of the expense. Also the possibility of extensive reuse of the forms on such work warranted the investment in permanent equipment. Steel forms have also been used for some time in the construction of concrete walls but so far have been limited to plain walls with a minimum of openings. The cost of placing metal wall forms is directly proportionate to the number of openings, which are more or less expensive to frame around. Steel wall forms have been used very successfully in the construction of retaining walls and dams with a resultant saving in cost and of timber. These forms are made of sheet steel and are usually held in place with channel or angle stiffeners. They are provided with holes for rivets, bolts or wire fasteners, are set up rigidly with ease, and will withstand the heavy pressure and weight of wet concrete.

The use of steel forms in building construction is rapidly being brought about by the standardization of the work, as it is only by repeated reuse that the steelform can be handled on a structure of this kind. The use of steel forms for circular columns and for flaring column heads, so often seen in so called flat slab designs, has proven so successful that they are now used almost universally. They are made of light steel sheets and in standard sizes adjustable to different diameters of columns. The steel sections are held together by steel bands made adjustable by means of keys. These steel column forms when erected do not carry any of the floor formwork and as a consequence can be stripped within twenty-four hours after pouring the concrete and reused immediately. Because of the many variations in sizes and the adverse stresses produced by heavy wet concrete, a square or polygonal steel column form has not been successfully devised at the present time.

Considerable advancement and complete success has been attained in the use of steel forms for forming up the floor construction in concrete buildings. The first type of steel form (non-removable) was brought into extensive use in 1911 and was designed principally to replace hollow tile in tile and concrete joist construction floors. These floortyle, as they were called, were made of light corrugated steel sheets and remained permanently in the building. While this metal acted as formwork before the concrete hardened, they performed no service by remaining permanently in the construction. Later various methods were used in attempting to strip these floortyle, but because of the corrugations this did not prove successful.

As an improvement over the floortyle the removable steel form idea for concrete floors was developed. At the present time these removable steel forms are used almost exclusively on the concrete slab and joist type of floor. This type of concrete floor consists mainly of a series of concrete ribs or joists placed approximately two feet on centers, four, five or six inches wide and from six to fourteen inches deep. These concrete joists are poured monolithic with the concrete slab which is usually two to three inches thick and which when finished on top gives the floor surface. The joists are carried on girders which in turn are supported on the columns. The whole when stripped and ready for use results in a concrete floor very similar to a wood joist floor in a frame building. The joist type of concrete floor is very economical especially for the lighter live loads, and well adapted for long span construction.

It is at once apparent from the preceding description of the joist and slab type of concrete floor that considerable standardization can be obtained in forming up these joists and this is where the economy comes in the use of removable steel forms. These are made in standard sizes and sufficient forms are usually furnished to form up one or more complete floors. If the building is several stories in height the steel forms are stripped and reused on the upper floors. The life of the steel form or the number of reuses obtained from it is dependent upon the thickness of the metal used and the care exercised in handling them on the work. They must be made out of metal stiff enough to withstand ordinary construction abuses and must not sag under the weight of workmen walking over them. They must be so constructed by tapering and beveling to permit ease in stripping. Stripping is also facilitated by oiling the steel forms before pouring concrete upon them. Special provisions must also be made for taking care of plumbing and conduit pipes, and hangers for ceilings, sprinkler systems, etc., as the ordinary methods of cutting up and boring of holes in wood forms cannot be tolerated in steel-forms.

Lately, steel forms for flat slab construction have been brought into use. Steel forms have also been devised for forming the slab panels of the so-called beam and slab design, but at the present time neither of these have had extensive use. The biggest problem yet to be solved in the use of steel for form work is that of forming up beams and girders. Several patents have been issued covering the use of adjustable steel forms for beams and girders but none of them are apparently practicable. The main problem consists in making such a form adjustable in length, width and depth. When this feature has been overcome, and it will surely be solved ere long, we will be ready to construct entire concrete structures by the use of steel forms with, at least a ninety-five percent salvage. Lumber waste from this source will be eliminated and our timber preserved for better and permanent uses. The cost of reinforced concrete construction will then be independent of the ever advancing price of lumber.

CONCRETING PLANT AND OPERATIONS

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A general review of advanced practice in field operations, and equipment for important concrete construction. Principal methods of loading, unloading, transporting, storing, reclaiming, and delivering cement and aggregate. Measuring and mixing cement and aggregate, character and installation of mixer delivery of concrete from mixer to forms, methods and apparatus for distribution and placing.

Cement is delivered for the job in bags by rail, by boat, and by automobile trucks and, with the exception of small quantities for daily supply, should be stored in a weather-proof building on a platform elevated beyond danger of moisture from below. One-story wooden sheds 20 to 40 feet wide are often built for the purpose and may frequently be so advantageously located that the cement is unloaded by hand on the floor and can be delivered by hand carts or through chutes to the mixing machine. If the storage house is not adjacent to the railroad and large quantities are to be handled, it will often be advisable to install some sort of loading or coveying apparatus to handle the bags; for this purpose belt conveyors, derricks with skips or large buckets, or locomotive cranes are most frequently available. Sometimes the cement can be stored in a building forming part of the permanent construction, where it is usually handled direct from cars or trucks or brought into a lower floor on carts or wheelbarrows and piled by hand.

In some cases economy is effected by purchasing the cement in bulk, in which case it is usually shipped on box cars like grain, or in open top cars thoroughly protected by tarpaulins. It can be unloaded by hand shoveling which, however, is very dusty and disagreeable, or by means of a mechanical shovel or scraper operated by power to transfer it a short distance to the storage bins. Open top cars may be unloaded by a clamshell bucket operated by a derrick and delivering to adjacent storage bins. The cement storage bins may be adjacent to or independent of the aggregate bins and should have an inclined bottom provided with one or more gates and chutes or spouts delivering by gravity to the batch container or directly to the mixer. A convenient form of outlet has a double valve with reciprocating parts so that, when one gate is closed, the other is open, and the required quantity for one batch is thus automatically measured and delivered by each operation of the controlling lever. A vent pipe is sometimes extended upwards from this apparatus to prevent the formation of a vacuum in the valve. Bulk cement may be elevated to the storage bins by bucket elevators operating in a boot on or near the car or boat; and bag cement may be conveniently handled in a horizontal or inclined position by endless belts, or in vertical or inclined position by bucket conveyors.

UNLOADING AND STORING AGGREGATE

Sand, broken stone and gravel are all handled and stored in substantially the same manner and all of them may be purchased, secured by the constructor at a remote point, or sometimes produced on the job. If the job involves excavation, such as tunnelling, canal, reservoir and some kinds of road work, the stone encountered, if of suitable quality can be broken to size in a portable crusher, elevated in a bucket elevator to a series of revolving cylindrical screens that deliver it according to size to different elevated bins, from which it is removed as required to general storage or to the mixer plant.

Sand, which may be derived directly from the excavation, can be treated in the same manner and may or may not require screening. In some cases it may have to be mixed for grading or may require washing, and for these purposes special apparatus can easily be designed and applied.

Gravel may also be derived from excavations on the work, or from a remote bank. It may or may not require washing or screening and, under certain circumstances, it may be found with sufficient fine material to serve both for stone and sand, requiring only the addition of cement to make concrete; but this is an unusual occurrence and requires close and constant attention to see that the quality and proportions remain satisfactorily constant. Frequently sand and gravel can be dredged with a clamshell bucket or dragline scraper in the bottom of a river, lake or pond and delivered by the dredge directly to the washing and screening apparatus; here it is cleaned and classified for the required purpose and finally delivered, usually by gravity or by gravity and bucket conveyors, to the storage bins.

The cost of the aggregate is a very important element on a concrete job, and the source, transportation and handling should be carefully investigated before any plant is installed or system adopted. Various systems have been well perfected and much standard equipment can be secured, all of which should be compared and the advantages and disadvantages of the different systems, or of a combination of systems, should be carefully studied. Estimates should be made, and the final plan should give due consideration to the rapidity of the work, the availability of different kinds of equipment and the salvage value after the work is finished. Preference should be given, of course, to well established methods and standard plants, rather than to untried or experimental features; but the engineer should have sufficient experience and ability to combine, modify or adapt, and even to invent, if the available systems or apparatus are not satisfactory, or if special details are necessary.

The ultimate criterion must, of course, be the total cost of the finished work, unless the latter be subordinated to special considerations of rapidity or coordination with other parts of the work; these principles govern the mixing and distribution of the concrete as well. It may in some cases be more advantageous in the end to do a large amount of hand work, where there is available labor that is otherwise idle, or where it is desirable to keep a large force on hand to maintain the organization or provide for emergencies, or where slow work is preferable to rapid, or where it is difficult to obtain the necessary mechanical equipment.

It may also be more advantageous to pay a large unit price that does not involve much waste, deterioration, or heavy investment in special machinery or perishable equipment, rather than to install an elaborate or costly plant that will take a long time to erect and is not readily salable or useful afterwards, even though the operating cost per unit of concrete is very small.

Plant that is on hand should be utilized if practicable without too serious inefficiency, and the selection of new plant should largely be influenced by the ease and rapidity of securing and disposing of it, its salvage value, and its probable value to the owner for future work, thus making standard appliances always preferable. The cost of storing and transporting plant and the probable cost of maintenance and repairs, as well as the possibility of renting it from other builders or of letting it when not in use, is also to be considered.

In all operations where a suitable location and arrangement can easily be secured, the movement of materials by gravity will generally be found advantageous even if it necessitates, as it generally will, hoisting materials in one way or another to a considerable height.

The greatest efficiency and economy is attained when the aggregate can be handled directly and continuously, for the minimum horizontal and vertical distances, from the source of supply to the mixing machines without interruption for re-handling, save for the maintenance of efficient permanent storage to insure against delays, breakdowns and interruptions.

UNLOADING

Cars, gondolas, scows, barges and the like are usually unloaded by clamshell buckets operated by derricks or by cableways. The clamshell buckets may deliver directly to storage bins or to storage piles, whence the material is reclaimed, sometimes, by the same buckets filling loading-hoppers, from which trucks are loaded at ground level.

When the aggregate can be delivered in bottom dump cars, the latter can discharge to the boot of a bucket elevator delivering directly to the bins, and it may be provided with a butterfly valve, enabling sand and gravel or broken stone to be shifted from the same elevator to either of two or three bins.

If possible, the storage should be located on a side hill where the material is delivered at a height sufficient to enable it to be moved from storage by gravity. When this cannot be arranged, it is often good policy to build an inclined track on a timber trestle high enough to afford sufficient storage for the aggregate on the surface of the ground below or, what is often more convenient, to enclose the sides of the trestle with heavy planking forming a bin underneath the track, that is filled directly from the cars above. This bin should be provided with bottom gates for the delivery of the material as required. When the material is stored on the ground, whether it is delivered by trucks, derricks, cars or otherwise, it may, in case of side hill storage, be piled up against a wooden bulkhead on the lower side that will enable it to be drawn off through gates; or it may be piled up against a bulkhead on level ground that will afford the same opportunity to a lesser degree. When delivered by automobile trucks, it is possible to build up a plank runway on the slope of the material and drive the trucks to the top of the pile, thus securing a large storage in one place.

One method of loading which is often found very convenient and economical is to excavate a narrow trench across the ground where the storage pile is to be made, install a narrow gage service track in the trench and cover the top of the trench with a plank floor in which gates are set at intervals corresponding to the distance apart of cars, center to center, in tiling on the service track. The material is then piled to any convenient height over the trench, and cars on the service track can be filled by gravity. This method involves shovelling or other rehandling to deliver material from the outside of the lower part of the storage pile.

Sometimes aggregate is delivered to the top of a storage pile by a four-wheel skip hauled on an inclined railroad. Sand and gravel have, in some cases, been transported for several hundred feet to storage piles or bins by water carriage through pipes or wooden flumes. When it is necessary to unload open top cars by hand, portable chutes can often be used to advantage. These are light steel troughs that can be hooked on the upper edge of the car and project over a truck or cart on the ground below. They are wide enough to accommodate two or more shovellers, and their length and inclination are sufficient to deliver the material rapidly to the truck at a convenient distance from the track and reduce the work of shovelling to a minimum.

Where it is necessary to take aggregate from the storage pile on the ground, a good result can often be obtained by a mechanical loader, of which there are several types, the general principle being that of an inclined bucket elevator mounted on wheels and operated by electricity or gasoline. The bucket elevator can be elevated or depressed, so that when the machine is backed up against the face of the storage pile, the bottom buckets will engage the toe of the material and cary it to the top of the incline, where the reversing buckets dump it into the car or truck which the elevator overhangs.

DELIVERY TO MIXER

When the mixer can be advantageously installed adjacent to the storage, and the latter can by gravity, deliver directly to the charging hopper, the conditions are then most favorable for rapid and economical work. If this cannot be arranged, it is very desirable to establish a secondary storage at the mixer with a capacity for at least a half day's work, so that mixing can be carried on continuously irrespective of slight irregularities in the delivery from the main storage. The latter should of course have capacity sufficient to continue the work over any period where there is likely to be any interruption of supply due to the weather, transportation difficulties, labor troubles or plant break-downs. When the main and secondary storage are not more than a few hundred feet apart, it will probably be advantageous on very large work to install some sort of continuous or semi-automatic delivery, such as endless belts, balanced inclines or, if possible, gravity spouting. If these are not practicable, resource will have to be made to some sort of car transportation, or to hauling by hand, team, automobile, or locomotives. Delivery to the second mixer should be so arranged that the aggregate from it can be drawn by gravity into the charging hopper, and this bin may be filled by any of the methods suitable for the main storage bin. As power is always necessary for operating the mixer, it is usually easy to have a sufficient excess to run a bucket elevator.

If dump cars can be used, they are preferable; but when not available flat cars may be used with detachable bodies, or independent skips, or buckets that can be handled by the derrick. In this case it is often desirable to have the bodies, buckets or skips accurately proportioned for the exact amount of aggregate necessary for one batch of concrete, so that they may serve as measuring boxes and may be emptied directly into the charging hopper; this saves rehandling, and maintains the contents of the secondary bin as a reserve using it only when there is an interruption of the supply direct to the mixer.

Wooden measuring boxes can usually be made to advantage by the contractor himself, of design and proportions suited to the special requirements of the work. They may be made with separate divisions for stone, sand, and cement; or they may have one or two adjustable interior marks, suited to different proportions for one batch. A number of such boxes loaded on a train of flat cars and passing under the spout of the storage bin can be very rapidly filled with the successive materials and, when an automatic measuring device is applied to the cement chute, only one mark or gate is necessary in a batch box. This may be placed low enough in the box so that the bottom is filled with sand up to that level, after which the box is put under the cement bin, and the required quantity of cement is automatically discharged into it without special measurement. Then the box is taken to the stone bin and filled completely full with stone or gravel. There are many different patterns of standard cast iron and steel gates for delivering stone, sand, and cement and it will usually be profitable to install them; but in case of necessity a contractor can easily arrange a gate, made of steel plate and timber frame, that will work very well.

TYPE OF MIXING MACHINES

Concrete mixing machines are standard equipment that can always be readily bought and sold in the market. As they are always subject to very hard service, often continuous, and liable to abuse and neglect, it is essential that they be of simple design, heavy construction and first-class material and workmanship. Most of them are of the general drum type with revolving body and interior blades, which lift and drop the aggregate until it is well separated and mixed, the principal differences being in the details and in the manner of charging and discharging them. Considerable variation is found in the different patterns that are specially adapted for different kinds of work, those for paving, for instance, being entirely different from those for building construction.

They can be purchased of varying size from a fraction of a yard to several yards capacity, but the general tendency is toward a larger number of smaller sized units, one yard machines being about the average for ordinary large jobs. Where concrete is deposited in very large masses and with the greatest rapidity, special larger machines may be used to advantage, but in any case, it is more desirable to have several machines than to have one, because this provides a reserve and allows one or more to be out of service for shifting or repairs without materially impairing the output. A multiplicity of mixers enables them to be distributed at different parts of a large piece of work, thus diminishing the distance which the mixed concrete must be carried.

It is desirable that all mixers on the job should be of the same make and, as far as possible, of the same size, so as to provide for interchangeability of parts and reduce the extra pieces kept on hand. They may be installed in batteries of two or more; they should be fed from the same bins and operated from the same charging platform, thus reducing the number of attendants and the cost of installation They should be mounted on steel or timber skids on a solid foundation with suitable protection, and at an elevation sufficient to enable them to discharge directly to the distributing cars or hoisting buckets; if necessary, however, the latter may be placed in the bottom of a pit, thus reducing the elevation of the mixer.

Where small units of construction are to be scattered over a large area, as in the case of foundation piers, long walls, or similar construction, it will be found convenient to have one or more small portable machines moving from place to place according to the progress of the work. Where a daily output of 100 yards or more is required, two small machines are generally better than one larger machine, both because they make a much more elastic system and can be separated and transferred to other work, and because the freight and installation charges are much less than for the equivalent large machine.

Portable machines are usually equipped either with a power loader or a loading platform, the latter usually costing 25 or 30 per cent less than the former, which has 20 or 30 per cent greater capacity than the platform machine. Where conditions limit the amount of concrete required to 50 yards or less daily, the platform machine is probably the most economical. Where these machines are charged by hand shovelling, great care should be taken to establish a minimum consecutive cycle of operation, so that no time is lost or interruption or obstruction occasioned by the men getting in each others way, or waiting for each other. Each man or party of men should work continuously in the same routine, particular care being taken to avoid confusion or collision between men approaching and those leaving the charging platform. A one-bag machine will require five wheelbarrow loads of 2 cu. ft. capacity, for each batch, and as each load requires at least 35 seconds for delivering the material, 10 seconds for operating the hopper, and 30 seconds for mixing, a minimum of 75 seconds will be necessary for each cycle. With wheelbarrows of 3 cu. ft. capacity, the cycle may be reduced to a possible 61 seconds. although the tendency is growing to require a full 60 seconds for mixing operations alone.

A power loading machine of 11 cubic feet capacity, called a one-bag machine, requires the same wheelbarrow time for charging but, as the hopper can be loaded while the mixing is in progress, only 12 seconds is required for elevating and discharging the hopper, and the minimum cycle is about 52 seconds. With gravity storage bins, the automatic charging of the hopper requires about the same time for any size batch up to two or three yards capacity; the time of charging will hardly exceed one minute, thus giving a maximum speed of 30 batches per hour allowing a full minute for mixing. The ideal arrangement of supplies for wheelbarrow charging is to have the sand and broken stone on opposite sides of the mixer, so that a wheelbarrow bringing a load of sand continues in the same direction across the platform and loads with stone returning; delivers the stone and continues to the sand pile; and so on back and forth, shuttle fashion, with no lost time or empty trips.

Water supply should always be carefully measured and fed into the mixer before the sand, cement and broken stone. Since too much water will injure the quality of the concrete and too little will not materially affect the operation of the machine, it is better to have too little than too much. In cold weather the water should be heated before being delivered to the machine, which is easily accomplished by running steam coils through the supply tank, or by injecting live or exhaust steam into the water through a perforated or open-end pipe. It is also necessary in very cold weather to provide systematic provision for heating the aggregate. This is best done by installing steam coils on the bottom and around the sides of the storage bins or under the storage piles; low pressure or exhaust steam is satisfactory for this purpose and should be provided in abundant quantities. If the steam supply for operating the mechanical plant is not abundantly adequate, an additional old boiler may well serve the purpose, if installed especially for this service.

For small sized, temporary, or detached operations, it may suffice to heat the sand, gravel or broken stone over horizontal flues in which a wood, coal or coke fire is maintained. Steam is also sometimes injected into the mixer during its revolution. If the concrete is delivered to position at a temperature well above freezing, and the upper surface is well protected, the heat developed by the chemical processes of setting will usually prevent it from freezing except in extremely cold weather. When concrete is placed in small masses however, the forms need protection against frost, whenever the temperature is much below freezing.

DISTRIBUTION AND PLACING OF CONCRETE

Concrete mixers usually deliver directly into dump cars or buckets, the former being used when the concrete can be discharged directly into the forms at a lower elevation, as into foundation pits, or from a trestle into wall forms and the like. Concrete buckets are usually transported for short distances by cableways and for longer ones on cars or automobile trucks, whence they are generally unloaded by derricks commanding the forms into which the concrete is emptied. The cableway usually brings the bucket into position over the forms, where they are dumped directly, but it may deliver them to derricks or other plant which transfer them to required positions. The buckets should usually be of proper size to take one batch of concrete, unless they have to be transported for long distances, when they may take two or three batches at once. Tilting buckets may be used, but bottom dump buckets are generally preferable and are indispensable for depositing concrete under water. Special buckets with adjustable gates are used for narrow forms and special purposes.

For building construction, dams and other structures, concrete is frequently delivered from the mixing plant to a bucket at the foot of a hoisting tower, from 50 to 200 feet high, in which it is elevated, to a receiving hopper at the top or at any intermediate point, where the contents are dumped. Usually the receiving hopper is provided with a gate through which the concrete is delivered to an inclined tube or trough, which spouts it to different portions of the work. Considerable advantage in spouting is derived from mixing a small proportion of hydrated lime with the cement, which makes the concrete more plastic and slippery. The proportion of mixing water should be about 1¼ to 1½ gallons per cubic foot of concrete.

The chutes are generally made in long sections of steel troughs, trussed and connected at the ends with swivel joints, supported in such a manner as to allow each section to be revolved through a wide horizontal angle, the last section delivering directly to the forms or to a small charging hopper, from which two-wheel carts are filled to transport the concrete a short distance. About 200 or 300 feet is the ordinary practical limit for spouting concrete, (a maximum distance of 700 feet has been recorded) and when this is materially exceeded, sometimes the concrete is delivered to a second bucket at the foot of an auxiliary hoisting tower, where it is elevated and spouted again.

The chutes are often suspended by adjustable light tackles from overhead cables, one end of which is carried at the hoisting tower and the other end at another tower or even extended to the ground beyond the limit of the work. The first end of the chute is always supported directly from the hoisting tower, and sometimes the outer end is carried by a boom attached to the tower, through which the chute passes. A second chute is often carried on the top chords of a cantilever truss and supports one end of a third chute, which generally is supported at the outer end on a light tower or trestle moved from place to place on the work.

When the concrete cannot be spouted to the forms in which it is to be placed, it is generally distributed for distances up to perhaps 100 feet in two-wheel hand-pushed dump carts running on plank platforms laid on the surface of the ground, on the floor, on trestles, or on top of the forms. This final distribution is often used for handling the concrete for large buildings, where the spouting may be eliminated, and the hoisting tower may deliver to loading hoppers on the successive floors.

In other cases, the two-wheel carts may receive the concrete directly from the mixer and distribute it up to a maximum distance of several hundred feet. The runways for these carts should bo made of light boards, cleated together in panels from 8 to 12 feet long, that can be very readily shifted and easily supported on blocking or trestles to provide for the proper grade, which should be from 1 to 2 inches in 10 feet, in favor of the loaded carts, not sufficient to accelerate their speed unduly or to make severe work pushing the empty carts upgrade.

A 250 x 250-foot concrete slab 10 feet thick was concreted from a single mixing machine that delivered into carts running on a platform 6 feet wide and extending across the full width of the concrete slab on the center line. It was elevated about 6 feet above the slab and graded down about 1 to 500. On each side of this platform there was provided at the same level a movable transfer table of the same width, extending across the slab transverse to the main runway. The 25 two-wheel carts were operated in pairs simultaneously filled from two gates of the loading hopper at the mixer, and one was pushed out on a transverse runway on one side and the other on the other side, from which they dumped their contents to the slab and returned. The grade of the runway was sufficient for the loaded cars to move by gravity at a speed which made it necessary for the attendants to hasten and made the work so rapid that it was necessary to relieve the men at short intervals. This method gave 100 per cent. efficiency, removing the concrete as fast as the mixer could deliver it, which is an unusual record for any construction work.

PNEUMATIC PROCESS

For years the mixing and placing of concrete by pneumatic pressure has been considered a *desideratum*, and considerable progress has been made in developing such a process. There are on the market numerous types of mixing machines in which the cement and aggregate are charged and subjected to jets of compressed air from several nozzles that tend to mix the materials; a gate is then opened, and the entire batch is forced through a pipe that discharges into the forms. Considerable difficulty has been experienced in securing a satisfactory and thorough mixture, but good results have been obtained by dry mixing the cement and aggregate before delivering it to the pneumatic mixer.

The pneumatic conveying portion of the apparatus has however proved very advantageous in some cases, especially where there is very limited clearance; notably in tunnel construction, where concrete for the lining can be delivered from the top or bottom of the shaft through a pipe laid on the invert or along the tunnel wall and occupying so little space that it does not interfere with tunnel cars or the other construction operations. On the other hand, the transportation of concrete in buckets or dump cars would very much obstruct the work, particularly in tunnels of small diameter, where only a single line of track can be used.

The delivery pipe is usually from 4 to 6 or even 8 inches in diameter and can be laid at any grade or even with perpendicular sections, but either horizontal or vertical deflections should be made with long radius bends. The concrete can be delivered through horizontal distances up to 1,000 feet or more and can be raised 50 feet with a working pressure of 100 pounds or less. The system is of course costly to install and it is found to require a very large amount of compressed air for its operation. It may however be economical when the cost of placing concrete by other methods exceeds $1.50 per cubic yard. The concrete quickly wears out the pipe at the bends, where holes are cut through the outer side of the curve, and the pieces require frequent patchings or renewal and are generally reinforced or made extra heavy or have detachable pieces at the exposed points.

CONCRETING UNDER WATER

Submerged concrete is usually placed in solid masses not requiring reinforcement or exceptional tension strength. It should however completely fill the forms making a solid mass and be protected so as to preserve its integrity until hardened and to prevent the washing away of the cement. Submerged concrete may often be placed in the dry, and water may be excluded until the concreting is completed, as in cases of concrete placed inside pneumatic caissons or cofferdams, or when a structure is concreted in a floating cofferdam sunk to position on a prepared foundation. This last method is occasionally used for bridge piers, sea walls and the like, where the ciasson itself is sometimes a plain or cellular concrete box, or where the system can be adopted that was recently devised by J. W. Rollins. His scheme consisted of building on shore a wooden cofferdam, detachably connected with a water tight joint to a permanent solid concrete base; this box-like structure was launched, towed to position, and gradually sunk on the foundation as the interior permanent structure was built up on the concrete bottom. After the work is brought above water level, the detachable sides can be removed and used over again, thus effecting great economy and rapidity.

With proper care and equipment, wet concrete can be safely deposited through and under the water, usually without much and sometimes without any work from divers, which is always costly. However, it may be desirable to have the bottom prepared to receive the concrete or to have it inspected by divers before the concrete is commenced and while it is being placed.

For depositing under water, concrete should never be of a lean mixture. Gravel is a more satisfactory aggregate than broken stone, because it flows more easily and is less liable to obstruction and the production of cavities. The materials should be delivered by boat if the water has sufficient depth, in which case the floating plant will usually be more satisfactory for a large job. On the other hand, when the materials are received by rail or the plant can be installed on shore or on an adjacent structure, a fixed plant may be most desirable. Other things being equal, the concrete can be handled from the mixer most advantageously by ordinary derrick booms, although sometimes cableways with very large buckets are suitable.

When a large area is to be covered with submerged concrete, it should be uniformly deposited in a continuous layer, 2 or 3 inches thick, with the strips zig-gazging back and forth continuously across the surface. An irregular surface of fresh concrete may sometimes have to be levelled by a straightedge drag or screen, heavily loaded or operated by divers.

Submerged forms for retaining masses of concrete may be built up to a limited height from an irregular bottom with jute or paper bags of fresh concrete handled by divers and built up like walls. Concrete in small quantities may thus be placed under water for many different purposes the concrete permeating the woven fabric of the bags and making a solid monolithic mass which may or may not be the case when it is placed in paper bags, although the fabric of the latter is generally believed to dissolve and allow the concrete units to bond thoroughly together.

Concrete cannot be successfully dumped into the water from a point above the surface nor deposited by lowering through the water in a tilting bucket, because the combined action of water and gravity tend to separate the fine and coarse particles and wash out the cement. The bottom and sides of the concrete should be protected from the water, but the top does not need special protection. A great deal of submerged work can be satisfactorily executed with a good bottom-dumping steel bucket, particularly for small areas and in protected spaces such as the interior of cribs, caisson pockets, and dredged wells, where there is little current of water to be contended with. A bottom-dump bucket may be provided with a tripping device to release the bottom flaps when it is just above the required emptying position; it is better, however, to have the sides extend a few inches below the bottom flaps and the latter arranged so that when the bucket comes to rest on the lower edges of the sides, the flaps are released; the bucket then automatically discharges its contents, still protected by the extended sides, and left exactly in the required position when the bucket is withdrawn.

It is important that the top of the bucket be left open so as to avoid the formation of a partial vacuum that would not only retard the emptying of the bucket, but would eventually set up a washing action that would injure the concrete. Submerged bucket work should be done with large masses of concrete and as little exposure to washing as possible, buckets up to 4 or 5 yards capacity being desirable when conditions permit.

When there is considerable lateral clearance and a large mass of concrete to be deposited under water, excellent results can be obtained by the tremie method, which consists simply in depositing the concrete through a tube, usually vertical, extending from above water level to the point of deposition of the concrete under water.

The great essential in this method is that the tremie shall be kept always filled with concrete and the operation shall be carried on continuously, so as to cause the uniform distribution of the concrete and maintain a concrete seal at the bottom of the tremie, thus preventing the entrance of water. The tremie, mounted on a carriage that is provided with both transverse and longitudinal motion or supported by a derrick boom or other suitable apparatus, is provided with a hopper at the top which must be kept filled from the adjacent mixer. At the beginning of operations the tremie is full of water, which is expelled by the first concrete that enters it; the concrete, however, becomes washed in falling to the bottom, so that it should be thrown away and operations commenced with concrete supplied after the first contents of the tube have escaped. The bottom of the tube should be maintained embedded a few inches in the surface of fresh concrete, thus providing a seal and enabling the full length of the tube and part of the hopper to be maintained full of concrete, which can only escape as the bottom of the tube is moved forward transversely to the end of its course. At this stage it should be shifted slightly longitudinally and moved back in a parallel transverse direction, and thus moved back and forth in a zig-zag fashion until the whole area of the structure has been covered. In this way the concrete builds up in successive, uniform, continuous, horizontal layers with as little interruption as possible; it may be necessary to raise the tremie and start operations over again if it has to be shifted from pocket to pocket of a caisson, or to avoid horizontal braces. On this account, where the unobstructed horizontal area is less than 200 square feet, the use of a bottom-dumping bucket is likely to be more economical than the tremie. The tremie should be large and arranged so as to be easily and accurately handled, and great care should be taken to maintain a continuous supply of concrete and prevent any interruption to its deposition under water.

For the piers of the Charles River Bridge, Boston, many thousands of yards of concrete were deposited in masses up to 62 x 207 feet and at a depth of 30 feet below high water; the tremie used was 35 feet long, 18 inches in diameter at the top and 24 inches at the bottom, and was suspended from a 6-yard hopper car traveling on a transverse bridge. The bridge itself rolled on longitudinal track extending the full length of the cofferdam, and commanded all parts of its area. The hopper was kept constantly filled with concrete and was discharged through a bottom gate as the car moved, depositing it at the rate of about 40 yards per hour. Another important case of successful tremie concreting was that of the four-track subway tunnel across the Harlem River. There a large quantity of concrete under, around, and over the four steel tubes, and inside a steel cofferdam and bulkhead was placed by several tremies mounted on a floating platform.

CORNELL SOCIETY OF CIVIL ENGINEERS

The Annual Spring Meeting of the Cornell Society of Civil Engineers was held at the Engineering Societies' Building, 29 West 39th Street, New York City, on April 9th, 1920, at 8 p. m.

All Cornell engineers were invited to attend and the results looked very encouraging for the proposed combined engineering society.

Amendments to the Constitution of the Cornell Society of Civil Engineers were suggested, changing the name to the Cornell Society of Engineers and providing for the eligibility of all Cornell engineers to membership. These proposals will be acted upon at the Annual Fall Meeting in October.

Dean Dexter S. Kimball, of the Combined Engineering Colleges at Cornell, delivered the principal address and was enthusiastically welcomed by the Society.

CONCRETE ROAD SPECIFICATIONS

By H. K. Bishop, '93, Chief Engineer
Indiana State Highway Commission

There is a wide range of opinion and more or less disagreement among highway engineers relative to the proper specifications for the construction of cement concrete roads. The Indiana State Highway Standard Specifications were prepared after considerable study of specifications of other States, and after consultation with some of our most experienced highway engineers. In writing this article, however, the writer does not wish to be understood to infer that the specifications prepared for Indiana are the best possible specifications for cement concrete road construction. The following will attempt to bring out some of the points with regard to cement concrete road construction which we believe important and essential to the construction of a proper cement concrete road.

Taking the Indiana Specifications as a guide, the writer will cover under the various headings, the important matters to be considered in the preparation of specifications for one course plain cement concrete pavement.

Description. Under this heading should be stated briefly the character of the pavement to be built and reference made to the Plans and Specifications which should give the width and depth of the pavement.

Portland Cement. Specifications for Portland cement usually can be made very brief, such as—"All cement used in this work shall be Portland cement which will conform to the requirements of the United States Bureau of Standards, Circular No. 33." A specification like the above fulfills all purposes and avoids a lengthy description in the body of the text. All parties interested can be furnished with copies of the circular mentioned.

Fine Aggregate. One of the most important materials used in the construction of cement concrete roads is the fine aggregate. This fine aggregate usually consists of sand. In Indiana we are particularly fortunate in having good sand and the only material used for fine aggregate today, is sand. The specifications for sand, in addition to requiring that it be clean, hard, durable grained, etc., provide that when dry, 100% shall pass a laboratory screen having circular openings one-quarter inch in diameter and shall be graded from coarse to fine. In addition to this, we provide that not more than 5% by weight, shall be removed by the elutriation test. In-as-much as it is results that we are after, it would seem that the strength test is extremely important. It is usually customary in writing specifications to provide that mortar composed of one part by weight, of Portland cement and three parts by weight of sand shall have a tensile strength at the age of seven (7) days and twenty-eight (28) days of not less than 100% of that developed by mortar of the same proportions and consistency made of the same cement and standard Ottawa sand. In this State we are particularly fortunate in having a sand which will show a strength ratio of anywhere from 125% to 190%. It would seem to us, therefore, that the proper points to be covered in writing specifications for sand in cement concrete pavement, are the grading and the strength ratio. The grading to be specified will depend somewhat upon the local sands available. With our Indiana sands we are inserting an intermediate grading in our 1920 specifications, requiring that not over 50% shall pass a No. 30 laboratory sieve. If stone screenings are allowed, it would seem advisable to raise the strength ratio requirement above that required for sand. There is evidence to substantiate the claim that a mortar composed of sand and stone screenings showing an equal strength ratio with standard Ottawa sand in the laboratory, will not develop the same strength in actual practice. It is therefore customary in many specifications to require an additional strength factor when combinations of sand and stone screenings are used.

Coarse Aggregate. The Indiana Specifications allow the use of crushed stone, screened gravel and, more recently, slag. Too much importance cannot be attached to the proper specifications for coarse aggregate and the proper inspection of material during construction. The specifications in addition to requiring that the coarse aggregate shall be clean, free from foreign matter, etc., should cover the grading. In Indiana the specifications provide that all of the coarse aggregate must pass a 2½ inch screen and that not more than 5% shall pass a one-quarter inch screen when tested in the laboratory. We also provide that the material shall be uniformly graded from the maximum size to the smaller size. This specification, however, is somewhat indefinite and not altogether satisfactory. We have been trying to work out some intermediate grade that will suit our local material and at the same time conform to the results of the tests obtained in the laboratory. As yet we have not arrived at a satisfactory specification for the grading between the maximum and the minimum sizes.

Water. The specifications for water should require that it be clean, free from oil, acid, alkali or vegetable substances. Ordinarily water used in the mixing of concrete is given very little consideration. We have found in some instances, however, that it is important and that water containing sewage, acids and alkalies are sometimes the cause of failure to obtain good concrete.

Composition. The matter of composition of concrete for cement concrete pavement is one on which highway Engineers will differ probably more than any other part of the specifications. There are certain limits, however, which might be stated as the limits between which it is advisable to work and which cover the range of good practice. These proportions are namely: 1:1½:3, 1:2:3, 1:2:3½ and 1:2:4. Theoretically the composition of concrete will depend more or less upon the character of the materials used as coarse and fine aggregate. Concrete composed of the same proportions will vary in strength due to the grading of the aggregates. Practically, however, it is generally considered good practice to adopt a combination of cement, and fine and coarse aggregate, that seems best suited to the materials at hand. Indiana has adopted the proportions of one of cement, one and one-half of fine aggregate, and three of coarse aggregate. In specifying these proportions, however, we specify that the concrete shall be composed of one part of Portland cement, one and one-half parts of fine aggregate and not more than three parts of coarse aggregate. We further specify that the aggregates shall be measured separately and accurately by volume so as to get the greatest density in strength. A further important provision is adopted in specifying that a cubic yard of concrete in place shall contain not less than 1.91 barrels of cement which is the theoretical amount corresponding to these proportions. A careful count is made each day of the cement used and the yardage laid, and the Contractor is required to conform to these specifications within a limit of approximately 2%.

Consistency. The requirements for consistency vary in different specifications. In Indiana we have adopted those originated, I believe, in Illinois, requiring that concrete shall be such that, when a cylinder or truncated cone 12 inches in length is filled with concrete and tamped until all voids are filled and a slight film of mortar appears on the surface, and the cylinder then removed, the vertical settlement or slump of the concrete shall not exceed a certain amount.

Mixing Concrete. Specifications under this heading should be definite and we believe should be confined to machine mixing. Our Indiana specifications require that the concrete shall be mixed thoroughly in a batch mixer of the boom and bucket type. The period of mixing is important and, while laboratory tests show conclusively that the longer concrete is mixed, the greater is its strength, we believe that the economical time of mixing is one minute. The strength gained by mixing concrete one and one-half minutes is not justified by the additional cost over that of concrete mixed one minute. In addition to specifying the time of mixing, it is important to regulate the revolutions of the mixer. All mixers are designed to revolve at a certain speed in order to give the best results. A good clause covering this part of the specifications is as follows: "Concrete shall be mixed thoroughly in a batch mixer of the boom and bucket type for a period of not less than one minute after all materials are in the drum, and during this period the drum shall revolve at the speed for which that mixer is rated by the manufacturer and which shall be not less than fourteen nor more than twenty revolutions per minute." Hand mixing should be permitted only when it is absolutely necessary to finish out some section, due to a break-down of the mixer.

Placing Concrete. Under this heading, it is important to carefully specify the manner of placing the mixed concrete on the subgrade. Important points to be covered are the sprinkling of the subgrade and the thorough compaction of same. It is advisable to use a template to insure the proper thickness of the concrete. The use of a template is equally important to the Contractor to insure him against extra depth due to low subgrade.

Finishing Concrete. Until very recently finishing the concrete was accomplished by hand methods. We now have two or more finishing machines on the market that mechanically strike and finish the concrete. In Indiana for 1920, we are specifying that a finishing machine must be used. The finishing requires the striking of the concrete to section, the tamping of the concrete to bring the mortar to the surface, and the belting of same. An additional requirement which is sometimes advisable is the use of the roller, generally known as the Macon roller. The finishing of the concrete is one of the most important parts of the work of building a cement concrete pavement. In order to have the pavement ride smooth, great care must be exercised to properly set and support the forms and to strike the pavement true to section. The use of the machine, we believe, is far in advance of old hand methods.

Forms. Specifications for forms are extremely important, especially if a finishing machine is to be used. Finishing machines are heavy and are liable to have considerable vibration. This weight and vibration has a tendency to settle the forms, thus producing a warped surface of the finished concrete road. It is important that the forms be securely set and that sufficient weight be given to the form to furnish the required stiffness and also that sufficient bearing area be given to prevent settlement if possible. In preparing the 1920 specifications, the Indiana State Highway Department went into this matter at some length and finally evolved the following specifications:

The outside forms for the concrete shall be of steel, having a top flange not less than two and one-quarter (2¼) inches wide. They shall be straight and rigid, of a height equal to the thickness of the pavement at the edge, and shall conform to the following requirements:

Weight of Finishing Machine	Bottom Bearing Area per Lineal Foot	Wt. per Lin. Ft. of rail only
3000 lbs. or under	39 sq. inches	6.5 lbs.
3000 to 4000 lbs.	48 " "	8.0 "
4000 and over	54 " "	9.0 "

The forms shall be staked at intervals of not more than five (5) feet and by such means as will maintain the required alignment and grade with exactness. The stakes must be so driven as not to interfere with finishing operations.

The Contractor shall provide sufficient forms so that it will not be necessary to remove them within twelve (12) hours after the concrete is placed. Before concrete is deposited against the forms, they shall be cleaned thoroughly and oiled.

Protection of Concrete. The protection of the concrete may be accomplished by several methods, the most common of which are ponding, a cover of earth and a cover of straw. The ponding method can only be used on low grades. It is very satisfactory for curing concrete but requires considerable care. The use of earth cover is the most common form of curing concrete and specifications usually provide that the earth cover shall be applied as soon as the concrete is sufficiently hardened to receive it. The actual time differs with the weather conditions and may vary from ten to twenty-four hours. The use of earth cover has one objection,—that it usually results in digging up the shoulders for material and leaves the pavement in a dirty condition on cleaning. We believe that one of the best methods of cover is by the use of straw. Sufficient straw is supplied to cover about eighteen days work. The straw is spread on the finished pavement about three inches in thickness and thoroughly wetted down with a hose. When the proper period of curing has elapsed, the straw is moved ahead by hand-car to cover fresh work. In addition to being less expensive than earth cover, it has the advantage of holding the moisture longer and leaving the finished pavement in a clean condition when removed.

Joints. Again we have a considerable difference of opinion among Engineers relative to the use or non-use of joints. In Indiana all of our concrete pavements are being laid without joints, except at the end of a day's work or when the concrete work is stopped for any appreciable length of time, when a butt joint is used. This butt joint is formed by placing a template at the end of a day's run and inserting five three-quarter inch bars four feet long through the template for about two feet into the concrete. In the morning the template is removed, exposed ends of the bars are wrapped in paper and the concrete for the fresh section is tamped thoroughly around them. These bars prevent any vertical motion or riding of the slabs, at the same time allowing a chance for contraction. The elimination of joints gives a smoother pavement and cheapens the cost of construction. The only objection that can be made to the practice is the fact that a crack does not look quite as esthetic as a joint. If properly cared for, however, under maintenance, and filled with asphaltic cement, no bad results develop. A crack never rides, the joint does. It only remains for someone to invent an asphaltic cement of a color similar to that of the concrete pavement itself, when cracks will be unnoticed.

There are some little points that the writer has picked up in his experience that seem to him to be of sufficient importance to mention in this article. One of them is longitudinal cracks and how they may be prevented. It is realized that again we may have a great difference of opinion on this subject. The writer believes, however, that longitudinal cracks are due to lack of uniformity of the subgrade. A subgrade that is unevenly compacted, especially when an old road surface obtains through the center of the pavement and the shoulders are built up of fresh material, is liable to crack longitudinally. Many specifications provide that the subgrade shall be plowed to a depth of from ten to twelve inches and compacted again with the steam roller. I have even known of instances where the subgrade was plowed and very little compacting done and where no longitudinal cracks have developed. It is extremely important to have a properly drained and properly designed subgrade. Very careful consideration should be given to this phase of the work on any cement concrete pavement job.

SOUNDINGS THROUGH WATER AND MUD

By John C. Trautwine 3rd, '00

In the region of the magnetite lodes that lie near the state boundary line of New York and New Jersey, is a rather large mine that has its mouth, M, Fig. 1, perhaps within a hundred feet of the shore of a lake. The lake is about a mile long and half a mile wide, and the ore has been worked out from the vein to a point at least a third of a mile under the lake, as shown at B.

As will be seen, though the figure is not drawn to scale, the mine dips down at about 20 or 30 degrees from the horizontal. Near its mouth, the top or roof of the mine approaches very closely to the bottom of the lake, as had already been ascertained by soundings and the mine surveys —perhaps to within 10 or 15 feet, as indicated at D. Further down, however, the indications were that the roof covering of solid rock was thicker, and the probabilities were that the greater the distance into the mine, the greater the thickness of solid rock constituting the "roof." Apparently, the most critical point had been reached at about D. Nevertheless, soundings had never been made more than a hundred feet or so out into the lake, and there was no real indication of the safety of the mine; and to have the lake break into such a mine, which could afford but one general avenue of escape, would have been a very serious matter, especially if the waters were to rush in at all rapidly.

Early in 1912 a cold snap set in and the lake was soon covered with ice thick enough to enable a party to go out on it, with a transit, if necessary, and lay off on it a "checkerboard," and make soundings through the ice— a far cheaper method, of course, than that of making the soundings from a boat, with the accompanying necessity for one or two transit parties on shore to locate the boat. Colored tags, lettered and numbered were used to mark the "stations," and were literally nailed down to the ice with large nails.

The soundings through the water were made with a wire, to the end of which was attached an old drill to act as a "sinker." No windlass was used for handling the wire, the wire being cut off into fixed lengths of one or two hundred feet, and the upper end of the wire being then laid out along the ice horizontally between "stations." The sinker was then lowered by one man through a hole, H, Fig. 1, in the ice, and a second man, R, holding the other end of the wire, walked, or frequently ran and slid, along the ice, until the sinker reached the bottom as would be indicated by the slackening of the wire. On taking up the slack, a simple measurement with the steel tape, from the outer end of the wire to the appropriate "station," would give directly the depth of the water under the hole.

However, the data obtained from these soundings, though more than covering the mine, gave evidence that they in themselves were not reassuring as to the safety of the mine. All but the edges of the lake, as indicated by the "feel" of the sinker through the wire, and as shown by the material brought up by the sinker, was covered with a sedimentary deposit of soft mud. In fact, the drill, if dropped rapidly, would come up (if the wire did not break and leave it down there, as happened several times), with mud clinging to it for a length of a foot or more. The material was very soft, was finely divided to the point of feeling slimey, and seemed quite homogeneous; but examination under a microscope revealed a display of brilliantly colored fragments rivaling a kaleidoscope. Moreover, the entire middle third of the lake was level enough to build a tramway on (though the tramway would have sunk in and disappeared!) while there was no such level tract of ground within many miles. Indeed, judging from the surrounding hills, the indications were that the real rock bottom, toward the middle of the lake, possibly lay a hundred feet or more below the surface of the mud.

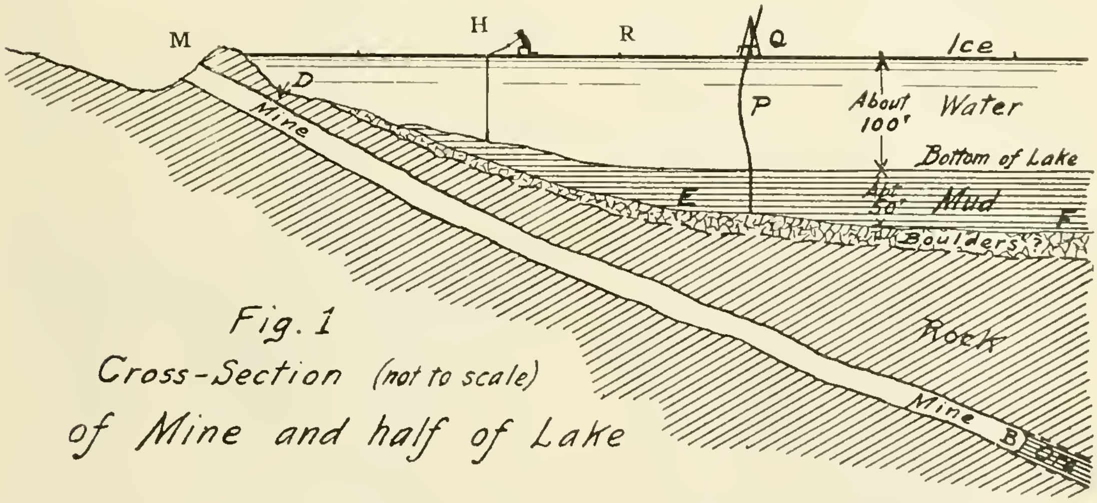


Fig. 1
Cross-Section (not to scale)
of Mine and half of Lake

In spite of the continued cold, which showed no signs of letting up, it did not seem wise to plan any ideal apparatus or to send to New York City for supplies for the purpose of attempting to sound down through the mud to solid rock. The reverse process was therefore used, of taking what could be found on the spot, and making the best of it. Fortunately but little seemed to be needed to make some kind of a try. A good supply of "two-by-fours" enabled the helpers, who were carpenters, to construct in the course of a morning a crude ten-foot derrick. They put a couple of wooden runners under it, and steps up one side, while the blacksmith stopped sharpening drills long enough to twist a bar of iron into the shape of a windlass which was attached to the side of the derrick, and a pulley was attached near the top. By postponing the installation of the steam radiators in some new buildings, an ample supply of three-quarters inch or one inch pipe was available.

The plan was, of course, to sled the derrick along the ice, adjust it over a hole, and lower one pipe length after another into the water down to the mud. As the combined lengths were lowered, a man climbed up the derrick with a new length of pipe, and screwed it onto the top of the assembled lengths below. This process was repeated until the pipe would go down no further. Before lowering the pipe, a rope was lashed to it, run up over the pulley, and back down to the "windlass," where it was given three or more laps (for the ice greatly reduced its coefficient of friction), so as to be able to pull the pipe out again. As new lengths of pipe were added, the rope was shifted to the new upper end so produced.

Having observed how beautifully a pile can be driven into sand by means of a jet of water alongside, and feeling that the mud was somewhat akin to sand, a pump was at first taken out with the outfit, and connected by means of flexible hose with the top of the pipe, after the pipe had reached the mud. Possibly this might have been made to work well if we had been able to spare time enough to keep the pump continuously manned to prevent it from freezing; but even when we did succeed in making it work, it did not seem to help the pipe down very much, perhaps because we could not produce a high enough pressure.

But, as is well known, a cork, once started twisting, can easily be withdrawn from a bottle. So we twisted our pipe with a pipe-wrench, and found that it went down through the mud surprisingly well. In Fig. 2, the man on the right is seen holding the wrench, the one in the middle has hold of the crank of the windlass, and the one on the left is holding the slack end of the rope.

Early in the work, while still not far from the shore, the pipe would sink 5, 10 or 20 feet or more, through the mud, before we could hear and feel its lower end gritting on the rock below, and it would refuse to go down any further. In such places the water depth was not very great. But something like a third of the way across the lake, the water depths had approached, and in some places exceeded, one hundred feet. Now a column of one-inch pipe, one hundred feet tall, would hardly be considered of ideal dimensions for drilling holes over fifty feet deep, even in soft mud. Yet that was what was actually accomplished. As soon as the pipe bore on the mud, the portion that projected above the ice, would begin to depart from the vertical as we let it down. We broke off one or two such columns of pipe, but soon learned that we could lower the upper end until the top would lean over perhaps 15 degrees or more from the vertical. Presumably the condition was about as shown at P. in Fig. 1. Then we would stop lowering, and apply the pipe wrench. Usually a half dozen twists would straighten the upper end to nearly vertical, which indicated that the lower end had gone on down and that the column was presumably nearly straight. The upper end, then, was supported by the rope, the middle portion partly depended from the upper portion and was partly supported by the lower portion, while the weight of the lower end alone exerted all the force available for penetrating the mud. Then we would lower again until the upper end leaned about 15 degrees, and then twist the pipe again until it was straight, or until our efforts were rewarded by hearing and feeling the gritting of the pip on the rocks.

Sounding through ice

Sometimes after gritting a little, there would be a jar and the upper end of the pipe would straighten once more. This indicated, of course, that a small rock had been encountered, but had been passed. Usually, the second time the gritting began it would continue indefinitely as long as the pipe was twisted. However, we could not assume that we had then surely encountered solid rock bottom. It was quite presumable that there would be some large boulders between the mud bottom and solid rock, which we could not detect from solid rock, and that these would be entirely incapable of holding back water. But the surface, DEF, of this collection of presumably loose rock, as determined by these "deep mud soundings," was not far from what might be expected by comparing it with the surrounding geology, and the mine sloped so steeply, that there seemed fair probability of ample protection of solid rock. Moreover, the close texture of the mud, which averaged fifty feet deep over the central portion of the lake, gave reassurance that should there be a crack in the roof of the mine, the water would have but little chance of filtering through at any dangerous rate, in spite of its hundred feet of head. The mud, instead of being a factor of uncertainty, now seemed, instead, to give promise of increased protection.

The evidence obtained was not convincing, as it could never be known whether the pipe was stopped by solid rock or by a boulder, and the depth of loose rock and boulders could only be guessed at. Nevertheless, it was better than nothing, and far more reassuring than ordinary water soundings, which, by themselves, gave an indication only of uncertainty. Besides, the cold snap had lasted so long that it could not be hoped that there would be time to await the development or arrival of anything much more elaborate for boring or drilling, though the ice had grown to a thickness of a foot or more, and could have carried quite a weight of apparatus. Moreover, the additional expense would probably have been out of all proportion to the value of the additional information that could have been obtained.

The extracting of the pipe was about as tedious a process as the sinking of it, for the pull was severe, even though assisted by twists from the pipe wrench, and the one-inch rod constituted none too small a windlass drum for the one-foot crank. Also, the pipe lengths had to be disconnected one by one—a procedure all of us shunned, because of the water that was released from the top length of pipe as it was unscrewed. Toward the middle of the lake, where the water was a hundred feet deep, and the pipe generally penetrated fifty feet of mud, and in some cases sixty feet and a little more, only two or three complete soundings could be made in the course of a day.

CHINESE GOVERNMENT SURVEYS

The Chinese Government has recently completed surveys for the improvement of about 200 miles of the Grand Canal through the fertile, deltaic plains of Shantung. In addition to the important problem of restoring through navigation on this ancient waterway and the Yellow River crossing, there were many interesting and complex problems of reclamation by drainage and irrigation, river control, reduction of drainage by floods, etc., the successful solution of which will benefit many millions of inhabitants.

These surveys were made by a corps of seven American engineers assisted by about seventy-five Chinese engineers and draftsmen, of which Joseph Ripley was Chief Engineer and J. W. Beardsley, C.E., '91, Assistant Chief Engineer.

The American International Corporation is furnishing the funds for both the surveys and the construction through loans made to the Republic of China.

PREVENTING SETTLEMENT OF CONCRETE-STEEL PILES

By G. H. S. McNair, '18

An investigation was begun in 1915, to determine the vertical and horizontal distribution of pressure in soils. It passed through the laboratory experiment stage; the knowledge thus gained was applied by engineers interested in pile driving to devise a method for eliminating settlement in piles; this method was put through field tests, and finally, through five years of modification in actual practice, became what is known as the "Pretest" method of driving concrete-steel piles. These five years of research and application represent an awakening of thought to appreciate the importance of the knowledge which has been gained by a searching enquiry into the nature of soft soils, and the distribution of pressure through them when loaded.

To be precise, it was in the *Engineering Record* of March 13th, 1915, that Professor Moyer of Penn. State University published the results of his laboratory investigation of the vertical distribution of pressure in soils. By means of a hydraulic jack resting on an area of one square foot, he applied loads to the sand contained in a large box, and measured the intensity of pressure at a given depth and at a given lateral distance from the center of loading, plotting the results as curves.

Professor Moyer's curves were converted by Mr. Greathead of the Public Service Commission of New York City, working in collaboration with Mr. Lazarus White and Mr. E. A. Prentis, of Spencer, White & Prentis, Inc., to show lines of equal pressure which would occur at the base of a loaded pile. Mr. Greathead called this pressure distribution the "Bulb of Pressure." It is shown in Fig. 1, and an understanding of the properties of this "Bulb of Pressure" is of the utmost importance in studying the behaviour of cylinders under load in soft soil.

However, no practical use was made of this knowledge until Messrs. White and Prentis, who had been using large numbers of concrete steel piles for underpinning construction, saw that the secret of the behaviour of piles in soft soils had been revealed in the theory of the "Bulb of Pressure" as truly as Dalton saw in his Atomic Theory the explanation of Chemical combination.

They then began a series of practical experiments in the field to confirm the laboratory work, and to apply it to a useful end. They used full-sized specimens and equipment, and performed their tests in the most typical fine sand of lower New York, which was available to them in a subway tunnel then under construction in William street. The curve shown in Fig. 2 corresponds to the following operations in the field:

A 14 inch diameter hollow steel shell was sunk into the ground, the sand removed from within and the shell filled with concrete, thus forming a solid cylinder with its base imbedded in the sand. Point "A" in Fig. 2 represents the initial application of load from a hydraulic jack (Fig. 3). Between points "A" and "B" the pile sank under increasing loads, until driving stopped at what was considered the full load of 45 tons. (Observe that the line "AB" represents the relation of stress to strain, in other words, the elasticity of the soil under this operation). During this stage, the particles of soil had been adjusting themselves to distribute the load over a wide area, as indicated in Fig. 1. At "B" the load was released. The pile showed a rebound along the curve "BC", rising a vertical distance of about three-eighths of an inch, but not returning to its original point "A". The soil, therefore, if one considers it as a homogeneous mass, possesses elastic properties, but does not truly obey Hooke's Law; and this was further seen when the load was re-applied at point "C". The pile settled along the curve "CD", a line resembling

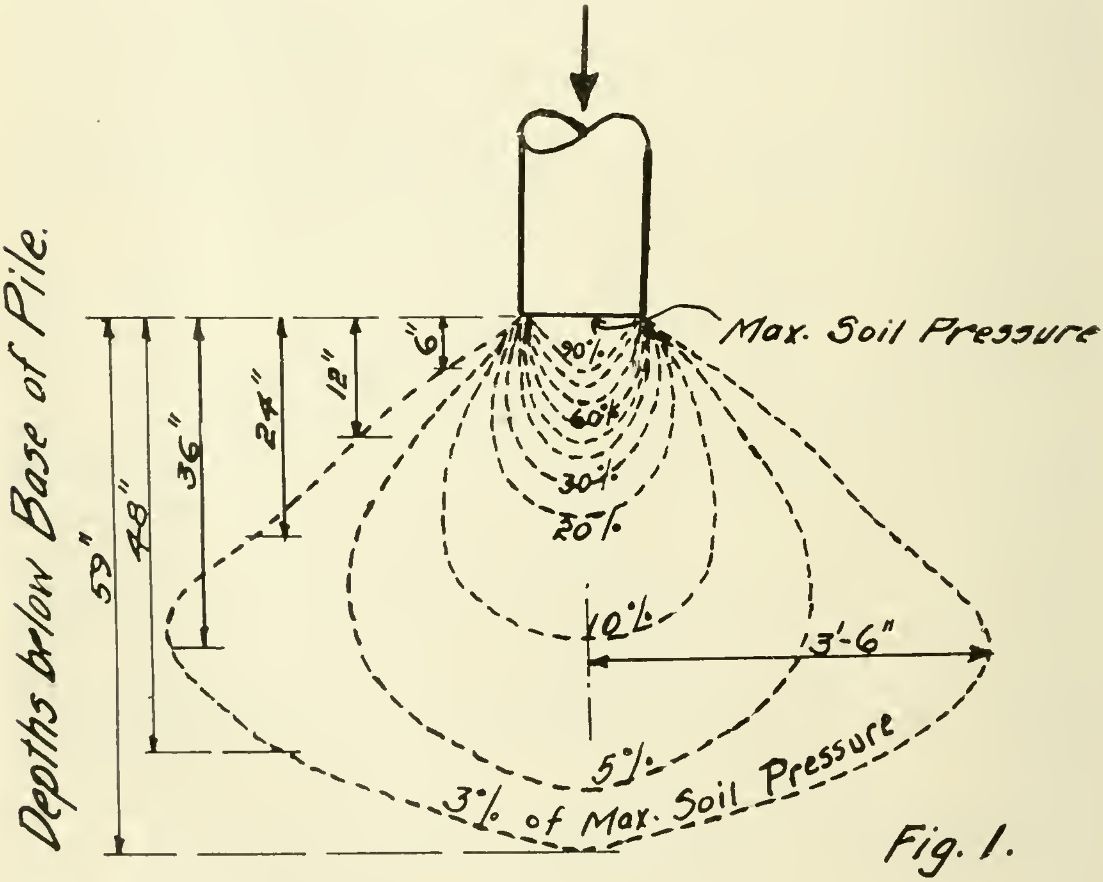


Fig. 1.

Soil Pressure under 14" Cylinder

THE BULB OF PRESSURE

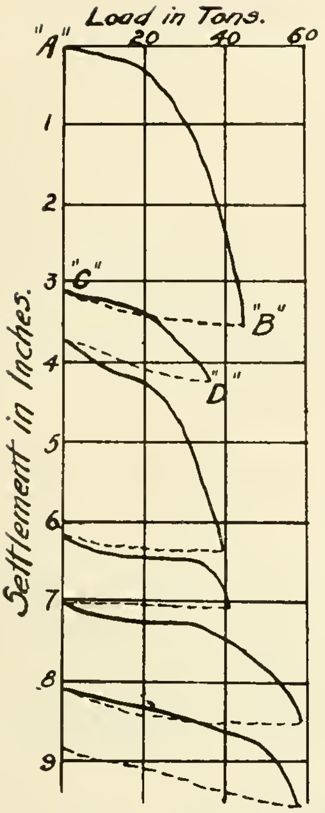
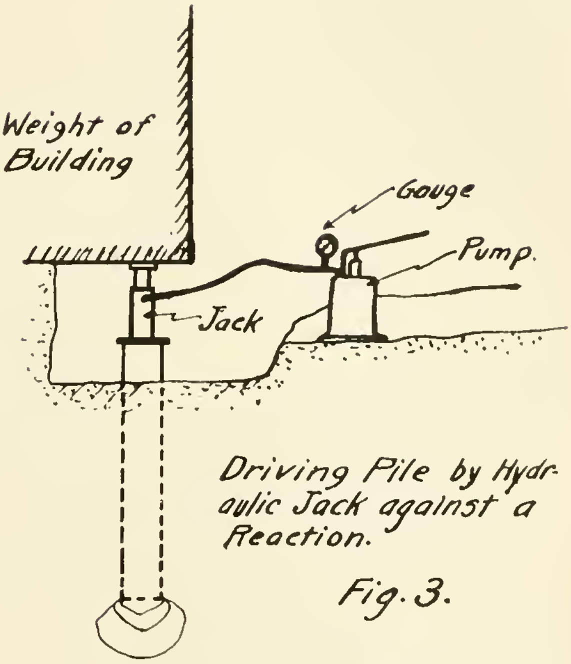


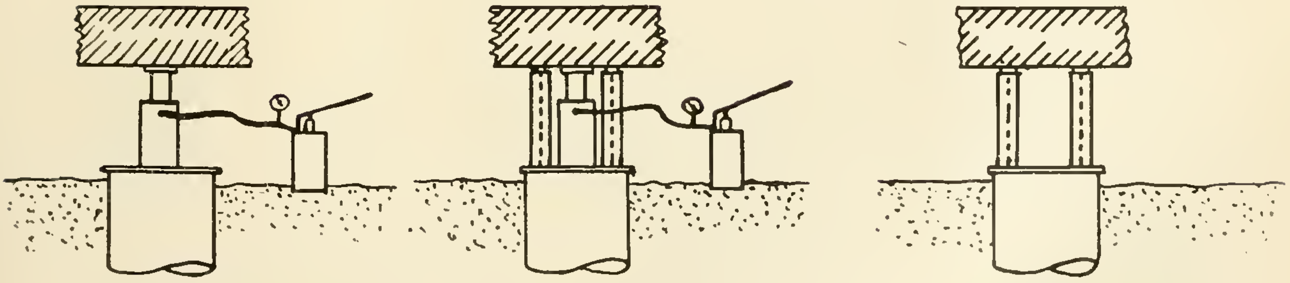
Fig. 2.

Tests on 14 inch Pile, showing Settlement and Rebound Curves.



Driving Pile by Hydraulic Jack against a Reaction.

Fig. 3.



Driving Completed

Struts inserted while test load is maintained.

Wedging Completed

PRETEST WEDGING

Fig. 4.

"AB", but below it, indicating that the compacting of the particles to form the "Bulb of Pressure" was gained along "AB", lost when the load was released between "B" and "C", and gained again along "CD" by further settlement.

The problem was to devise a method of driving the piles in such a manner that the "Bulb of Pressure" could be gained and never lost. It was necessary to abandon the then accepted practice of driving these piles, namely, pressure till the required depth was reached, followed by the removal of the hydraulic ram, and then the introduction of a column between the top of the pile and the footing or other load it was to support, because, and this is the crux of the situation, the building required a settlement of one to two inches before the pile fetched up under its newly applied load.

This settlement had been regarded as unpreventable, though it had never before been explained. With the explanation came the remedy. By introducing a system of wedging which transferred the permanent load to the pile before the driving pressure was removed, the release along curve "BC" was prevented, and the subsequent settlement along "CD" had no opportunity to take place. Fig. 4 shows graphically the method of doing this wedging. It is known as the "Pretest" system, and is a patented process.

The reader can now realize that there has been eliminated the one factor which has hitherto prevented piles from sustaining in soft ground, without fear of settlement, the heavy column loads of modern office structures.

THE CORNELL CIVIL ENGINEER

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Ithaca, N. Y.

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EDITORIALS

Elections THE CIVIL ENGINEER takes pleasure in announcing the election of John J. Chavanne, Jr., '21, of Woodhaven, L. I., to the position of Junior Associate Editor, and of Miss F. M. Delaney, '22, of Watervliet, N. Y., to the Sophomore Editorial Board. The Board also wishes to express appreciation of the excellent work performed by Earl R. Andrew, '21, during the recent competition.

The 1920-1921 Board The Board takes great pleasure in announcing the election of the following 1920-1921 Board of Managers and Editors: Editor-in-chief, Donald Griswold Cockcroft, of Northport, N. Y.; Business Manager, Francis A. Regan, Jr., of New York; Managing Editor, Earl Jacob Sherk, of Harrisburg, Pa.; Advertising Manager, Edwin F. Chobot, of New York; Alumni Editor, John J. Chavanne, of Woodhaven, N. Y.; Circulation Manager, Roy E. Pratt, of Franklinville, N. Y.

The new board will assume their duties commencing with the May issue of the CIVIL ENGINEER. We bespeak for them the same hearty cooperation and a continuation of the interest so generously manifested by our alumni during the past year. We wish to take this opportunity to thank especially all those who by their articles have during the past year contributed to the success of the publication. Questions of important changes in policy must be settled in the near future. We confidently look for the new Board, guided by the constructive criticism and advice of the alumni, to successfully meet and settle these problems, and to realize more completely than ever before the aims and ambitions of almost a generation of editors.

Concrete

What is the future of concrete in the world of construction? Will the next twenty years see an increase in the amount of concrete used in construction proportional to the increase during the twenty years just passed? The answer must lie in the methods used in carrying on that construction. Concrete is somewhat like the little girl in the nursery rhyme, in that "when it is good, it is very, very good; but when it is bad, it is—worthless!" And, even in recent years, it must be admitted that there is a great deal of poor work being done with concrete; far too much, in fact, considering the vast amount of experience, experimenting, and writing which has been furnished to the engineering world during the past decade.

In this issue we are presenting discussions of various phases of concrete work, by engineers who are prominent in their respective fields, and who are thoroughly cognizant of the most approved methods in general practice at present. The articles cover a great variety of phases and we invite comment or criticism from our readers.

Mr. John C. Trautwine, 3rd, '00, assistant editor of Trautwine's "Civil Engineer Handbook," has furnished us with a description of a method of making soundings through ice, water, and mud which was apparently much superior to the usual method of making soundings. Very and apparently accurate results were obtained by using lengths of small satisfactory diameter pipe which sank through as much as fifty to sixty feet of mud simply by its own weight plus the effect of turning the pipe with a large wrench.

Service Number

The Service Number which has been delayed to make possible greater completeness and greater accuracy will appear in May. A great deal of effort has been expended to make this a reliable record of all Cornell Civil Engineers in military or naval service during the World War. It will include the records of 1000 men who have at some time been students in the College of Civil Engineering. The price of this issue will be one dollar and if additional copies are desired they should be ordered from the CIVIL ENGINEER at once.

COLLEGE NOTES

The Acting President of Cornell University During Dr. Schurman's trip to Japan as a member of the party of guests invited to that country by the Welcom Association, the Board of Trustees have chosen Albert W. Smith, '78, to act as president of Cornell University. For the first time in its history this university has a Cornellian in the presidential chair, and we feel certain that this has been a wise choice on the part of the trustees.

We are indeed fortunate to be able to place our trust in a man who has all the attributes of a real Cornellian. During his undergraduate life President Smith took an active part in the school activities: he rowed on the first freshman crew organized here; for the following three years he held a position on the varsity; and as president of his class and class orator, he combined the athlete with the scholar. With these experiences for a background to his undergraduate life, the best interests of Cornell have always held a predominant place in his heart as all who have been connected with him will affirm.

A practical engineer, with the idealism of the teacher, and the vision of the poet, such is President Smith. For, upon graduating in '78, he spent the next eight years in the engineering business. Then, returning to the graduate school here, he secured a fellowship and later a professorship in Sibley College. He left here to become the head of the engineering departments at Wisconsin and later at Stanford, after which he returned to Cornell as Dean of Sibley College—which position he has occupied for the past sixteen years. Besides writing "Materials of Machines" and "Machine Design," he has published a book of poetry, has written a number of Cornell verses and songs, and has been a frequent contributor to college publications.

Undergraduate Endowment Fund Campaign

The undergraduate endowment fund campaign is in full swing and up to date, the returns have been very favorable. The first wave of this campaign was started at a breakfast held for the endowment fund committeemen and members of fraternity organizations. The next step was taken by the women's organization; at a supper held by them, at which Professor Durham spoke, the members present pledged $19,600 which, added to the $59,000 pledged in the first breakfast get-together, started the fund rolling upward. The third step took the form of a convocation of all students in Bailey Hall at which time $234,000 was pledged. Every day brings in additional totals and at the present writing more than $850,000 has been subscribed and no one can predict where the total will stop.

The purpose of the drive is of course to secure as large a subscription as possible, but it is also to make the fund represent as large a part of the undergraduate body as possible. Having this financial responsibility resting on their shoulders when they graduate will do more to keep Cornellians interested in the progress of their Alma Mater than any other thing.

Convocation Hour for Honor Students

The first convocation to honor scholarship was held Friday, April 9th. On the program were the names of students who by high standing had won a place either in the University Honor groups, or in one or more of the honorary scholarship societies. There were 382 names in all, including 36 in the Honor Group for the College of Civil Engineering, and several C.E. men in Tau Beta Pi.

An address was given by Dean Andrew F. West of the Graduate School at Princeton. His subject was "Wanted: An Education." He made an earnest plea for the kind of education which teaches how to live, rather than the kind which merely helps one to earn a living, and he urged co-operation between the two kinds of education, the liberal education and the technical.

The Fuertes Memorial Prize Public Speaking Contest

On Friday evening, April 16, was held the Fuertes Prize Public Speaking Contest with the following results:

The first prize of $125 was awarded to W. D. Ellis, M.E. '20, who spoke on the affirmative of the question, "Resolved, that a reinforced concrete arch bridge should be built across Cascadilla Gorge connecting West Avenue and Eddy Street." The speech was both well delivered and most convincing.

E. T. O'Brien, C.E. '20, who spoke on the negative of the same question, was awarded the second prize of $35.

The third prize of $20 went to C. M. Stotz, B.Arch. '20, who spoke on, "A Commercial Building as a War Memorial." The other speakers were: C. M. Cormack, C.E. '20, on "The Shop Committee System"; H. W. K. Hartmayer, C.E. '20, on "Some Proposed Changes in Engineering Education"; W. S. Schmidt, M.E. '20, on "The Adaptation of the Worker to His Work"; C. F. Ostergren, M.E. '21, on "The Shop Committee versus the Trade Union System."

The Penn Relays

The Penn Relays, which are to take place on April 30, and May 1, promise to be of supreme importance in determining the Intercollegiate winners. Cornell has been picked as the only institution in this country to defeat the Oxford-Cambridge team, which is entered in the two mile relay.

A list of 43 entries has been forwarded to Penn. From these entries will be picked the men who will represent Cornell. As a result of the showing made in the Michigan Meet, Cornell's chances seem to be most favorable. It is expected that Cornell will win the long distance events.

Baseball

The baseball team made a Southern trip during the recent Spring vacation. On April 1st, the Varsity trimmed Georgetown University by a 6–5 score after the latter had previously beaten Yale 8–1. The following day they won from University of Virginia by an easy margin, 7–2; but they lost to John Hopkins University on April 3rd by a 10–13 count. The game scheduled with Penn. on April 5th was cancelled on account of wet grounds. Cornell is fortunate this year in having a team of heavy hitters, in a recent game between Varsity and Frosh, Davies, star half back of last fall, made a home run by knocking the ball clear over the club house, which was declared to be the longest hit on record at Percy Field.

The schedule is as follows: April 24, Colgate at Ithaca; April 28, West Virginia at Ithaca; April 30, Amherst at Amherst; May 1, Harvard at Cambridge; May 5, Colgate at Colgate; May 8, Columbia at New York; May 12, Princeton at Princeton; May 15, Amherst at Ithaca; May 19, Lafayette at Ithaca; May 22, Yale at Ithaca; May 26, Bucknell at Ithaca; May 29 Penn at Ithaca; May 31, Penn at Philadelphia; June 2, Maryland State at Ithaca; June 5, Yale at New Haven

ALUMNI NOTES

'71. Miller A. Smith wishes to announce that the firm of Smith & Davis, Consulting Engineers, has been dissolved and that the new firm of Smith, Ames & Chisholm, Consulting Engineers, has been formed. The new firm is located at Lonja del Comercio 508, Havana, Cuba.

'84. Daniel W. Mead, Consulting Engineer, Madison, Wis., has been engaged by the Grand River Drainage District of Livingston County, Mo., to act as consulting engineer in connection with flood prevention plans worked out for the Grand River Valley by the Morgan Engineering Company, Memphis, Tenn.

'90. John F. Skinner is a consulting engineer practising in the city of Rochester. He gives his address as 56 City Hall, Rochester, N. Y.

'92. Captain Walter B. Dole is at present stationed at Camp Holabird, Md.

'95. Norman B. Livermore is president and controlling owner of N. B. Livermore & Co., Pacific Car & Equipment Co. and North Western Equipment Co.

'95. John Edward Thebaud has changed his address from 363 Potomac Avenue, Buffalo, N. Y., to 973 Ellicott Square, Buffalo, N. Y.

'98. M. A. Tenney's present address is 4303 Walnut Street, Philadelphia, Pa.

'00. J. C. Trautwine, 3d, has relinquished the direction of the editing of Trautwine's Civil Engineer's Pocketbook, although still associated with that work, and is undertaking private practice in research and development.

'01. Colon W. Neville is a contracting engineer in New Orleans, La. He lives at 2226 Canal Street, New Orleans, La.

'01. Major Irving C. Brower is in the Construction Division of the Army and is stationed at Camp Custer, Washington, D. C

'03. John H. Lewis, for 14 years State Engineer of Oregon, has associated himself with R. R. Clark for the purpose of carrying on a general practice as consulting and managing engineers, under the firm name of Lewis and Clark.

'05. Major Carl Ashley is now Construction Engineer for the T. A. Gillespie Company of New York City, N. Y.

'05. The Fourth Edition of Merriman (American Civil Emgineers' Handbook) has recently appeared. As in the three previous editions, the index is by Clinton L. Bogert. Mr. Bogert is also part-author of "Waterworks Handbook" by Flinn, Weston, & Bogert, now in its second editon.

'05. Chester N. Reitze, formerly District Engineer of the Seattle office of the Portland Cement Association, has been appointed District Manager of the Pacific Coast offices of the Association at Seattle, Portland, San Francisco and Los Angeles.

'06. O. H. Linton is vice-president and manager-director of the Canadian Comstock Company, Limited. He lives at the University Club, Montreal, Canada.

'06. Walter J. Bryan is engineer in charge of location and construction of railways, saw mill, town, etc., for the Weyerhaeuser Timber Company at Snoqualmie Falls, Washington.

'06. E. R. Williams is General Manager of the Matanzas Public Service Company, Matanzas, Cuba. F. Ponce de Leon, '10, is managing a Sugar Refinery that has been built by six Cornell alumni, in the same place. The Refinery was built in 60 days, and has a capacity of 200.000 pounds per day.

'07. R. M. Davis is Statistical Editor od the Electrical World. His address is 1015 Rhode Island Avenue, N. E., Washington, D. C.

'07. Raymond E. Toms is now located at the Post Office Building, South Chicago, Ill.

Ex '08. M. Z. Bair is Chief Engineer on the Arkansas State Board of Health. His address is Little Rock, Arkansas, care of State Board of Health.

'08, '96. William L. Lance, '08, Engineer, Spring Brook Water Supply Co., Wilkes-Barre, Pa., has resigned to become associated with John H. Lance, '96, Consulting Hydraulic Engineer, of that city.

'08. Ralph A. Smallman of Birmingham, Ala., is vice-president and treasurer of the Smallman Building Construction Company of Birmingham.

'08. Edwin R. Thomas now has an interest in the firm of L. E. Locke & Son, of Lawrence, Mass. They are engaged in mill and heavy construction.

'09, '04. Hart Cummin, '09, formerly sales engineer, Platt Iron Works Company, Dayton, Ohio, has become associated with Gaylord C. Cummin, '04, New York City, in the practice of consulting municipal engineering.

'09. Charles Frank Seifried is with the Wyoming State Highway Commission, Cheyenne, Wyo., as Chief Draftsman.

'09. R. B. Stanton, Jr., is Sales Engineer for the U. S. Cast Iron Pipe and Foundry Company of New York City. His address is 71 Broadway, New York City

'09. G. R. B. Symonds is Chief Engineer of the Bureau of Engineering of Nutley, N. J.

'10. Merwin Armstrong is Superintendent of Levee Construction in Arkansas. His address is Langford, Ark.

'10, '17, '15, '15. H. F. Critchlow, '10, who is in the Water Engineering Department of Conservation and Development, at the State House, Trenton, N. J., writes to tell us that other C.E.'s in the State House, Trenton, are C. H. Capen, Jr., '17, P. N. Daniels, '15, and I. R. Riker, '15.

'10. Warren E. Day has been discharged from the army and at present is connected with the Electric Bond & Share Company as a Structural Designer.

'10. Loring K. Warne is president of the Marion Sand & Gravel Co., of Marion, Ohio.

'10. Glenn B. Woodruff is now employed by the Lehigh Valley Railroad as Assistant to the Bridge Engineer. His home address is Wysox, Pa.

'11. Weston Gavett is Assistant Engineer for Clyde Potts, C.E., of 30 Church Street, New York City.

'11. Captain Eugene L. Hartman is stationed at Camp Humphreys, Va. He is engaged in training engineering troops.

Ex '11. Lieutenant Colonel Thomas O. Humphreys is in command of Fort Story, Va.

'11. Paul Bloss is Structural Engineer for the Ford Motor Company. His address is 520 Park Road, Ambridge, Pa.

'11. R. L. H. Tate is Assistant Engineer for Surinamche Bauxite Maatschappij in Dutch Guinea, So. America. His address is P. O. Box 218, Paramaribo, Dutch Guinea, So. America.

'11. Major C. M. Thiele is still stationed at the Coblenz Bridge-Head with the A. E. F. He is in the office of the Adjutant General of the A. E. F.

'12. R. W. Austin is in the Technical Department of the General Motors Export Corporation in New York City. His address is 30 E. 60th Street, New York City.

'12. Chester A. Adee has been discharged from the army and is now a Patent Attorney for the Western Electric Company.

'12. Ray Y. Gildea is living in Baltimore again. He is an engineering assistant with the C. & P. Tel. Co. of Baltimore.

'12. R. C. Hill is Draftsman for the Interchurch World Movement. He lives at 261 Fair Street, Paterson, N. J

'12. Hollister Johnson is Assistant Engineer for the Conservation Commission at Albany, N. Y. His home address is Dryden, N. Y.

'12. M. C. Johnston is in the employ of the Henrico Lumber Co. His address is 707 Chamber of Commerce Building, Richmond, Va.

'12, '11, '16, '14. Edmund Lynch, '12, has changed his address from 32 Harrison St., Crafton, Pa., to 39 S. Emile Street, Crafton, Pa. He is now Sanitary Supervisor of mills for the American Sheet and Tin Plate Co., 1410 Frick Building, Pittsburgh, Pa. He informs us that George L. Hendrickson, '11, and Grover E. Rickard, '16, are connected with the American City Engineering Co., Peoples Bank Building, Pittsburgh, Pa., while Thomas Thornton Newbold, '14, is a Field Superintendent for the Raymond Concrete Pile Company.

'12. Paul B. Sutton has been appointed City Engineer of Watertown, N. Y.

'12. Edward Hooker Taylor is an Engineer with the Austin Co., of 16,112 Euclid Avenue, Cleveland. Ohio.

'13. Herbert A. R. Austin is the 1st Assistant Engineer for the City and County of Honolulu, T. H. He gives his address as No. 20 Kapiolani Building, Hodolulu, T. H.

'13. Edwin G. Bolger is District Engineer in charge of Coal Property Development for the Peabody Coal Company at Marion, Ill. He may be reached at P. O. Box 168, Marion, Ill.

'13. A. B. Cozzens is Assistant Manager of the Factory Products Corporation of New York. His address is 255 E. 28th Street, Brooklyn, N. Y.

'13. Lynn B. Curry is now employed by Gannett, Seelye & Fleming, Inc., of Harrisburg, Pa., as Civil Engineer. He may be reached at the following address, care Gannett, Seelye & Fleming, Inc., 204 Locust Street, Harrisburg, Pa.

'13. Ernest W. Eickelberg is located with the United States Coast & Geodetic Survey as a Hydrographic and Geodetic Engineer. His home address is 302 Oakmont Avenue, Baltimore, Md.

'13. Charles D. Farlin, until recently connected with the Montreal Light, Heat & Power Co., of Cedars, Can., is now with the Fraser, Brace & Co., of Staten Island, N. Y.

'13. Frank Herrmann gives his address as Box No. 1, Santa Fe, New Mexico. He is a Bridge Engineer for the State of New Mexico.

'13. Harvey T. Munn writes us that his address has been changed from 1016 Munroe Street to 1017 Rodney Street, Wilmington, Delaware.

'13. R. W. Parkhurst is salesman for the Barber Asphalt Paving Company, of Philadelphia, Pa. His address is 611 W. 136th Street, New York City.

'13. Samuel L. Taylor at present is with the U. S. Bureau of Public Roads at Minneapolis, Minn. He is the Senior Highway Engineer.

'13. Charles Weiss is Assistant Supervisor of the Pennsylvania R. R. at Dunkirk, N. Y. His address is 247 Gregory Ave., Passaic, N. J.

'14. O. M. Clark is Sales Manager for the Kosmos Portland Cement Company, of Louisville, Ky. His address is 1330 Cherokee Road, Louisville, Ky.

'14. Captain Frederic W. Conant is stationed with his regiment at El Paso, Texas.

'14. Albert Charles Dunn is engaged in Federal Aid Road Construction in Washington, D. C., Maryland and Delaware as Highway Engineer for the U. S. Bureau of Public Roads, Washington, D. C.

'14. Emory W. Lane has secured a leave of absence from the Miami Conservancy District for a few months during which time he will act as drainage census taker for Louisiana and other southern states. Mr. Lane is planning to leave for China in the early fall to study flood problems there and also to deliver a course of lectures at Chinese universities.

'14. Ralph S. Sollitt has been elected vice-president of Ralph Sollitt & Sons, Construction Co., Chicago, Ill. They are engaged in general contracting work.

'14. Edward R. Stapley is located in Geneseo, N. Y., at present. He is secretary and assistant manager of the Geneseo Automobile Company, Inc.

'15. E. S. Baker is Advertising Manager of the A. B. Smythe Company of Cleveland, Ohio. His address is 9610 Clifton Blvd., Cleveland, O.

'15. C. C. Cooman is Draftsman with the Sinclair Refining Company of Chicago, Ill. His permanent address is West Webster, N. Y.

'15. Errol W. Doebler is a Designing Draftsman with Hager, Whipple & Fuller, of New York City.

'15. Porter V. Hanf is now employed by R. A. Trufant on Irrigation Work at Llano Grande, Texas, as Chief of Party.

'15. John E. Harn has been elected Secretary-Treasurer of the Willard E. Harn Co., Inc., of Baltimore, Md. He is at present engaged in building construction work.

'15. Seth G. Hess is at present employed by Morris Knowles, Inc. of Pittsburgh as a Housing and City Planning Specialist. He is the Senior Assistant Engineer of the company.

'15. W. A. Priester is with the Priester Construction Company. His address is 811 W. 7th Street, Davenport, Ia.

'15. I. Russel Riker is Assistant Sanitary Engineer for the State of New Jersey engaged in water and sewage plant supervision at Trenton, N. J. His address is 62 Crane Street, Lawrenceville, N. J.

'15. Armando Vivoni is now employed by Central Romana as an Assistant Superintendent at La Romana, Dominician Republic.

'16 A. F. Bacharasch has severed connection with the U. S. Railroad Administration and has entered the New York Office of the Turner Construction Company. His address is 617 Hudson Street, Hoboken, N. J.

'16. M. Bernstein has resigned his commission as 1st Lieutenant in the Regular Army Infantry, and is now with the Truscon Steel Company at Syracuse.

'16 M.C.E. A. Charles Irwin is an Engineer in the Structural Bureau of the Portland Cement Association. His address is 411 N. Ashland Ave., La Grange, Ill.

'16. Harmon C. Kibbe is at present employed by the State of California as a Mechanical Draftsman on Heating and Ventilating Work. He is living in Berkley, California.

'16. C. B. Moore is at present Junior Enginer with the U. S. War Department, being Chief of Topographic Party. His mail may be addressed Care Camp Benning Survey, Columbus, Ga.

'16. Frederick B. Mullen is now Superintendent of the H. J. Mullen Construction Company. He is engaged in Sewer Construction Work at Janmaica, N. Y., at present.

'16. Arthur F. Perry is at present located with the Texaco Company as a Civil Engineer. He is engaged in construction work at Port Arthur, Texas.

'16. Reinaldo Ramirez has changed his address to Box 51, Cabo-Rojo, Porto Rico.

'17. David Beale is now a rancher. He gives his address as Careywood, Idaho.

Ex '17. Harold Day is still in the army. He is doing maintenance work in France.

'17. W. Reise Dillard is now located at 923 South Boston Ave., Tulsa, Okla.

'17. Aram H. Dimijian is at present located in Rome, Ga., as a Resident Engineer for W. C. Spiker, a construction engineer of Atlanta, Ga.

'17. Theodore W. Hacker is now connected with Norton, Bird & Whitman as a Resident Engineer on Water Supply Construction at Brunswick, Md.

Sp. '17. Roy J. Hart is at present a Mathematics Instructor in the Greensboro High School, Greensboro, N. C.

'17. Ernst William Kurz is at present employed as a Structural Engineer by Schenk & Williams of Dayton, Ohio.

'17. Goichi Nakamoto is now at 1515½ Fifth Avenue, Los Angeles, California.

'17. John O. Preston has resigned from the staff of the Rochester Bureau of Municipal Research, Inc., and has accepted a position as assistant to G. H. Ley, Chief Engineer for the I. K. Davis Company, Contractors and Engineers of Twentieth and Spencer Streets. Philadelphia, Pa.

'17. LeRoy P. Raynor of Riverhead, N. Y., is at present a Junior Hydrographic & Geodetic Engineer with the Hydrographic, Topographic, and Geodetic Survey of the Philippine Islands with headquarters at Manila, P. I.

'18. Samuel Strummer is employed at present by the Fougner Concrete Steel Company of 29 Broadway, N. Y. C., as a Designer and Estimater.

'17. Stephen A. Theard of 43 Neron Place, New Orleans, La., is running a general contracting business in that city.

'18. John R. Bedell of Valley Falls, N. Y., is at present employed by Alexander Brothers of New York City as a salesman of belting and mechanical leathers.

'18. Harry Bobker has been elected President of the Bobker Construction Company of Brooklyn, N. Y. He is engaged in superintending construction in suberban development.

'18. Walter R. Burke has been elected Vice-President of the engineering firm of Burke Brothers of Scranton, Pa. At present he is engaged in superintending the building of a reservoir at Clarks Summit, Pa.

'18. Lester H. Fackiner of Division Ave., Summit, N. J., is a member of the Bureau of Engineering of Nutley, N. J.

'18. Frank V. Fields is at present employed by the Department of Public Works of the Dominican Republic, W. I. He is a resident engineer on some highway construction through the tropical jungles of the Republic.

'18. Sigmar K. Hofeller has been elected President of the Crescent Concrete Company of Buffalo, N. Y.

'18. Herbert B. Knox is President and Treasurer of Chas. McCaul Co., Contractors and Secretary and Treasurer of the William Adams Iron Foundry. He is living at Narbeth, Pa. His offices are in Philadelphia.

'18. John E. Laird is a partner in the Heath Mfg. Company of St. Louis. He is General Sales Manager of the Company. They specialize in the making of dyestuffs.

'18. William M. Leffingwell is the Secretary of the Glen Springs Corporation of Watkins, N. Y. He is the Assistant Manager of some work that they are doing in Hotel-Power Plant Construction.

'18. George H. McNair is located with Spencer, White & Prentis of New York City as an engineer. He is engaged in the Construction of Foundations.

'18. Alfred Mulliken, formerly First Lieut., Sanitary Corps, in command of the 82nd Sanitary Squad, A. E. F. has been appointed Assistant Sanitary Engineer, New York State Department of Health.

'18. James B. Woodbury of 432 Franklin Street, Danville, Ill., is Advertising Agent for the Manufacturers Publicity Bureau of 406 Marquette Bldg., Chicago, Ill.

'19. Curtis B. Bennett of 507 West Main Street, Richmond, Ky., is Junior Assistant Engineer with the Cleveland Railway Company at Cleveland, Ohio.

'19. Morris G. Cohen of 1398 St. Marks Ave., Brooklyn, N. Y., is now a Draftsman with the N. Y. & N. J. Bridge and Tunnel Commission.

'19. Frederick W. Crane is in the Design Department of the Lackawanna Bridge Company at Buffalo, N. Y. He also says that Raul Luchetti, '19, is estimating for the same organization. F. W. Crane is residing at 60 Tennyson Ave., Buffalo, N. Y.

'19. Earl S. DeWitt of Hammondsport, N. Y., is now employed by the Burroughs Adding Machine Company of Detroit, Mich.

Ex '19. Daniel L. Dargue has been elected Vice-President of the Phoenix Realty Company of Los Angeles, Cal.

'19. J. C. Gebhard is with the Bethlehem Steel Bridge Company at Harrisburg, Pa. His address is 45 N. 19th St., Harrisburg, Pa.

'19. Abbott Philip Herman is now Draftsman for the American Bridge Company. His address is 627 Maplewood Ave., Ambridge. Pa.

'19. G. S. Hiscock is with the McClintic-Marshall Company at Pittsburgh, Pa. His residence is 415 Biddle Ave., Wilkinsburg, Pa.

Ex '19. Wallace A. Howes is a member of the firm of Howes Brothers, Lumber Dealers, of Florence, Mass.

'19. S. Kaufman is with the Turner Construction Company of New York City. He lives at 1389 Stebbins Ave., New York City.

'19. J. H. Lynch, jr., is Chief of Corps in the Maintenance of Way Department of the Erie Railroad. His address is 237 Plymouth Ave., Buffalo, N. Y.

'19. Ross Linzy Milliman of 34 Linden Street, Rochester, N. Y., is District Manager for the Association of Army & Navy Stores, Inc. His business address is care of the Association, New York City.

'19. Reginald Waldo is Junior Assistant Engineer in the State Highway Department. His address is Campbell Hall, N. Y.

'19. Chilton Austin Wright of New Rochelle, New York, has finished post graduate work in experimental hydraulics and the degree of M.C.E. has been conferred upon him.

'20. Horace Simrell Owens is now with the Goodyear Tire and Rubber Company, Akron, Ohio, where he is instructing in mechanical drawing. He is living at 48 McNaughton Street in the same city.

Ex '21. Walter C. Christensen is now located with the C. & S. Co., dealers in building material, of Perth Amboy, N. J.

Ex '21. James T. Lowes is at present employed by the Maintenance of Track Division of the B. & O. R. R. He is living in Baltimore.

Ex '21. Rex McReynolds is in the oil business down in Texas. He is Vice-President of the Tee Pee Oil Company of Wichita Falls, Texas.

IN MEMORIAM

ELLIS DUNN THOMPSON, C.E., Class of 1876

DIED AT WEST PHILADELPHIA, PA., FEBRUARY 9, 1920

The death of Ellis D. Thompson, '76, occurred at his home in West Philadelphia on February 9, 1920, after an illness of ten days with influenza.

Ellis Dunn Thompson was born in Newark, the son of the late Judge James T. Thompson and Sarah Bishop.

After receiving his degree in civil engineering at Cornell, the deceased was for some time an engineer in the government service and did considerable work along the Mississippi River. For the past two years he had been a consulting civil engineer with the emergency Fleet Corporation of the U. S. Shipping Board.

Mr. Thompson married May La Monte. His widow and one daughter Marjorie La Monte Thompson, survive him.

Mr. Thompson was a member of the University Club of Philadelphia and the Engineers' Club of New York.

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By courtesy of White Studio

Captain Adelbert Philo Mills
Member of Faculty who Died in Service

THE CORNELL CIVIL ENGINEER

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EDITORIALS

The Service Record

It is with the feeling of having but very poorly and inadequately recognized the splendid service rendered their country by those men who were at some time undergraduates in the College of Civil Engineering that The Civil Engineer issues this Service Number.

A great deal of time and effort has been expended to the end that this record may be complete and reliable and it is our hope that the degree of its completeness and reliability may be at least commensurate with the amount of time and effort spent upon it. Most grateful acknowledgement is due Professor Fred Asa Barnes for his constant and invaluable assistance in the work of obtaining informaiton, compilation, and proof-reading. A large part of the information herein recorded was obtained from the Honor Roll compiled for the Cornell Society of Civil Engineers by Mr. Carroll R. Harding, '10, of the Committee on Military Records. This Honor Roll was furnished us in its entirety and we desire to make acknowledgement to Mr. Harding and the Cornell Society for this great aid. Questionnaires were sent by the Civil Engineer to every man known to have been in the service and all previous information was checked with the information thus obtained

It has been our desire to pay our small bit of homage by the contribution of some permanent record of all C. E. men who served the colors. Their record was noteworthy and illustrious and can but reflect most gloriously upon the College from which they went. In many branches of the service and upon many fields they proved themselves most worthy representatives of that College and their country and bore aloft the standards which they who follow will ever strive to maintain.

COLLEGE NOTES

Endowment Fund Campaign

The latest report of the Endowment Fund Committee shows that the Undergraduate Campaign was a remarkable success. The four classes in the University at the present time have subscribed an amount just a few thousand dollars short of the million dollar mark. When all odds and ends are cleared up, it is very probable that this original goal will have been passed.

The success of the Undergraduate drive, together with the untiring efforts of Professor Durham, has had a wonderful effect on the national campaign. Complete reports from all over the world will doubtlessly show that the returns will be far beyond expectations. Many thousands of Cornellians have taken advantage of this splendid opportunity for showing their loyalty to their Alma Mater. With such support the Producer of Producers will go on forever.

Cornell Civil Engineering Association Banquet

The Cornell Association of Civil Engineers held its first banquet since the war at the Dutch Kitchen. About three hundred of the members were present, including practically every member of the Faculty. The affair was a great success and left no doubt that the old C.E. spirit is as strong as ever.

After a wonderful feed, we were treated to several humorous (?) stories and four excellent addresses. The speakers were Charles H. Baker, '86, Frederick W. Scheidenhelm, '06, Dexter Kimball, who will be the Dean of the combined Engineering Colleges next year, and "Nicky Bawlf," our popular lacrosse coach. A. E. Hunkin, '20, and

J. A. Ross, '20, entertained us with some interesting stunts, and Professor L. C. Urquhart, '09, made an excellent Toastmaster.

Lacrosse

One of the bright spots in Cornell athletics for the past year was lacrosse. The team enjoyed a very successful season, in which they lost but two games out of nine. Those who were taken into camp by the Varsity were Yale, Harvard, Penn, Hobart, Swarthmore, and Maryland State, while they lost to Syracuse and Johns Hopkins.

The game with Syracuse was of double significance. It was, first of all, the deciding game for the championship of the Northern League, and secondly it marked the reopening of sport relations between the two great Universities of Central New York. The game ended in a 3 to 3 tie and had to go an extra period, at the end of which the score was 5 to 3 in favor of Syracuse, and Cornell had to be contented with second place in the league standing.

The success of the team was due to a great extent to the wonderful ability of Coach Bawlf. Coming here just three days before the season opened, he quickly moulded a machine of game fighters, worthy of the name, Cornell. Mr. Bawlf is not certain that he will be able to stay with us next year, but it is to be hoped that after putting lacrosse on the map at Cornell and winning a place in the hearts of all of us, he will not leave us for several years.

Crew

The Grand Old Man has come to the front again and during the present year has added considerably to his long list of victories. In their first yacht race of the season with Princeton and Yale as their opponents, Courtney's Varsity and Freshmen crews swept Carnegie Lake. The Varsity led Princeton by half a length and Yale by two lengths, while the Freshmen won easily, being six lengths ahead of Princeton and nine ahead of Yale.

One week later both crews again cleaned up easily on Lake Cayuga in a dual race with Harvard before a large Spring Day crowd. Now all crew enthusiasts are anxiously awaiting the annual regatta, in which Columbia, Penn, Syracuse, and Cornell will take part, the Navy having declined the invitation. Since Syracuse has also beaten Princeton, a close and interesting race is expected, but we feel confident that Cornell will still remain the "Champions of all."

Baseball

At the beginning of the season Cornell's baseball prospects were very bright. But when Olsen, who had been elected Captain, and who was considered the best college pitcher in the East, was put on probation, all our hopes were shattered. Coach Henry raked over the material on hand and produced a team which had a fairly successful season and from which big things may be expected next year, as most of the squad will be back then.

To date the Varsity has won but seven out of sixteen games, but most of those which were lost were close, extra-inning contests. Then, when it is remembered that they defeated our old rival, Penn, by a score of 6 to 3, they are excused for all their losses.

Intercollege Baseball

The championship of the Intercollege Baseball League was won this year by the Chemistry nine, after they had gone through the season undefeated. The C. E. team was late in hitting its stride and had to be content with fourth place. However, near the end of the season, we had a fine combination on the field and finished up the season by beating M. E. easily by the score of 12 to 0.

Interfraternity Baseball

The Interfraternity Baseball season was also very successful this year. There were eight leagues of six teams each in the field, and the leaders of their respective leagues were the following: Alpha Tau Omega, Alpha Gamma Rho, Kappa Psi, Omega Tau Sigma, Alpha Psi, Beta Theta Pi, Theta Chi, and Pi Kappa Alpha. These teams played for the championship, and Pi Kappa Alpha was the successful contestant, thereby winning the large silver cup.

C. E. Summer Camp

The Junior Surveying Camp will be held this year during June and July with headquarters at Ovid, which is about 25 miles north of Ithaca on the west side of Lake Cayuga. At a meeting of the students who are to attend, the following officers were elected to serve as the camp; Chief Engineer, F. W. Lake, '22; Assistant Chief Engineer, A. H. Kohler, '22; Quartermaster, W. G. Cobb, '22; Assistant Quartermaster, F. E. Conklin, '22; Commissary, Frances Delaney, '22.

SERVICE RECORD
OF THE
COLLEGE OF CIVIL ENGINEERING
CORNELL UNIVERSITY

Including the service records of all graduates, former students, and undergraduates who served in the World War

The dates on the first line indicate time of service; those within the record itself indicate the date of transfer, change of rank, etc., noted immediately after the date. Data regarding rank, location, etc., are not repeated in case they remain the same.

Adams, Arthur .... *CE* '01 .... 1 Ja 18 to 8 Au 18
Major Adm Officer Inspt Div Ord Dept Washington D C; 10 Ap 18 Inspt Mgr N Y Ord Dist; S 18 Lt Col

Adams, Morris .... *CE* '09 .... O 18 to N 18
EOTC Cp Humphreys Va

Addams, William Jr .... *CE* '17 .... 18 Jn 18 to 30 N 18
CATC Ft Monroe Va; 25 S 18 2d Lt CA Instr.

Adee, Chester A .... *CE* '12 .... 30 Jl 17 to 13 Jn 19
Au 17 1st Lt Engrs Constr France; S 18 127th Engrs; Ja 19 122d Engrs

Aitchison, William M .... *CE* '12 .... 28 S 18 to 22 Au 19
2nd Lt QMC; Constr Div Cp Bowie Tex; Aberdeen Proving Grounds Md; Ap 19 Lt Engrs Util Div

Allen, Gardner P .... *CE* '16 .... 27 Au 17 to 16 Jl 19
CA OTC Ft Monroe Va; 11 F 18 1st Lt 60th CA; 22 Au 18 8th Aero Sqdn France; 30 Ja 19 Cp Le Mans France; Awarded DSC

Allen, Lindley A .... '13 .... 1917 to 1919
Capt 4th Depot Reg Cp Sherman O; 813th Pioneer Inf France; Cp Knotty Ash Liverpool England; Univ of Wales

Allison, William F .... *CE* '04 .... 1 Mr 18 to — — —
Major Engrs France

Anderson, Christian S .... '15 .... 1917 to date
CACTS Ft Monroe Va; 1st OTC Plattsburg NY; 2nd Lt 74 Ca France; Ft Totten NY

Anderson, James A .... *CE* '17 .... 7 Jl 17 to 5 Jl 19
Capt QMC Disb Off Richmond Va; 16 O 17 Asst Div Quc 30th Div Cp Sevier SC; 11 My 18 Capt & Major QMC Disb Off 30th Div France; 11 S 18 Asst to Optns Off Hdq 1st Army; 21 Ja 19 Major & Lt Col QMC Asst to Adm Off Hdqt 7th Corps: 3 Major Operations

Anderson, Ross S .... '22............................. O 18 to D 18
SATC CU

Anderson, William C .... *CE* '14................. 14 My 17 to ———
1st Lt 25th Engrs France; Toulouse Univ France

Anderson, William H L.......... '17.......................... 1 My 17 to 1919
15 Au 17 2d Lt; 1st Lt Inf Army School France

Andrew, Earl R .... '21............................. O 18 to D 18
SATC C U

Andrews, William A .... '19...................... 11 N 17 to 5 Ja 19
5 Ja 18 USSMA Urbana Ill; 5 Mr 18 Cp Dick Tex; 18 Ap 18 Rich Field Tex; 1 N 18 2d Lt; 10 N 18 Rockwell Field Calif

Andrus, Clift .... '12........................... 1 My 17 to 19
1st Lt FA Hawaii

Antell, Tristan .... *CE* '13................... 21 Jl 17 to 1 F 19
Pvt 8th CAC NG NY; 23 Au 17 OTC Plattsburg NY; 15 D 17 1st Lt 351st FA; 15 My 18 92d Div OTS & FACOTS 18 Jl 18 Aberdeen Proving Grounds, Md; 25 O 18 Off Ch Ord Off Engrg Div France

Armstrong, Donald A .... '18 ....
Co D 104th MGBtn; 2d Lt AEF

Armstrong, Merwin .... *CE* '10.................. 8 My 17 to 20 Mr 19
Madison Barracks NY; 11 Jl 17 Capt Engrs American Univ Washington DC; 1 S 17 105 Engrs 30th Div Cp Sevier SC; 15 Jn 18 France; 26 S 18 27th Div; 3 Major Engagements; Wounded Slightly

Ashburner, Lesley .... *CE* '06..................... 1 My 18 to — —
Pvt 305th San Train France

Ashley, F Carl .... *CE* '05........................ Au 17 to O 19
Capt ERC Material Engr Paris France; 25 My 18 Supt Inland Water Transptn Dist of Paris; 31 O 18 Major

Ashton, Herbert .... *CE* '13................... 15 D 17 to 24 Jl 19
Sgt 41st Engrs; 18 D 18 Pvt 20th Engrs

Astry, Perry D .... '18....................... 15 Ap 17 to 9 Ja 19
Jn 18 1st Cl Pilot (Naval Avtr) Coco Solo C Z; 27 D 18 Lt (jg) USNRF; 9 Ja 19 Inactive Duty

Atwood, William G .... *CE* '92.................. 11 Jn 17 to 18 Au 19
Major 17th Engrs (Ry Constr) St Nazaire France; 26 F 18 Lt Col; D 18 Det Ser with H Hoover; 25 F 19 Col Am Repr Com Sec Sup Econ Council Paris France; Officer of Legion of Honor (France); Order of St Sava Grade 2 (Serbia); Title unknown (Poland); Citation from GHQ AEF

Aull, Ludwig .... *CE* '10.........................
Pvt Engrs

Austin, Herbert A R .... *CE* '13.................. 15 Jn 18 to 17 D 18
1st Lt ERC Stu EOTS Cp Lee Va & Cp Humphreys Va; 4 O 18 Engr Tr Rgt; 27 O 18 9th Engrs Tr Rgt Cp Fremont Calif

Austin, Robert W .... *CE* '12................... 1 S 17 to 26 Au 19
EOTC N 17 2d Lt 104th Engrs; Ja 18 France; O 18 1st Lt; N 18 Asst Adj. Gen Paris; Mr 19 Capt Engrs

Ayres, Percy H .... '12......................... F 17 to — — —
Essex Troops State Cav NJ; Mil Pol Aniston Ala; Jl 18 216th Co MP 3rd Army France; 26 My 19 Coblenz Ger

Babcock, Maurice L .... *CE* '11.................... 6 My 18 to My 19
Ensign CEC USNRF Asst Inspt Off Philadelphia Pa; D 18 Lt (jg)

Bache, Harold L................ '16..................... 17 My 17 to 23 D 18
OTC Plattsburg NY; 2 S 17 2d Lt 308th Inf; 6 Ap 18 77th Div France; 30 Jl 18 1st Lt Instr Cp Shelby Miss

Backer, William B	'21	S 18 to F 19	2d Lt TC USA F 19 USR Inactive Duty
Bacon, Ethelbert	*CE* '12	27 Au 18 to 28 N 18	EOTS Washington Barracks Washington D C & Cp Humphreys Va
Bailey, John S	*CE* '14	13 Mr 18 to 13 Jl 19	Pvt to Sgt 20th Engrs France; (E)OTS France Rec for Comm
Bair, Morris Z	'08	1 Au 18 to Ap 19	Capt QMC Constr Div Washington D C; Cp Taylor Ky; Cp Kearny Calif; Arcadia Balloon School Fla
Baker, Edwin S	*CE* '15	25 Au 17 to 13 F 19	27 N 17 2d Lt CAC Ft Mott N J; 1st Lt CAC Anti-Submarine Duty
Ball, Ethan F	*CE* '14	2 S 17 to 20 D 18	2d Lt Stu OTC; D 17 Instr OTC; My 18 Engr Rpl Troops; Jl 18 1st Lt 212th Engrs Cp Devens Mass
Ballard, Wilson T	*CE* '16	14 My 17 to 17 Jn 19	Cadet OTC Ft Meyer Va; 15 Au 17 2d Lt 305th Engrs Cp Lee Va; 15 Mr 18 1st Lt 305th Engrs AEF
Balser, Lewis F	*CE* '17	15 D 17 to 17 Jn 19	Pvt 23d Engrs France
Banta, Russel V	*CE* '09		Pvt Inf
Barasch, William	'21	O 18 to D 18	SATC C U
Barker, Clifford V K	'22	O 18 to D 18	SATC C U
Barnes, Harry W	'21	1 O 18 to 15 F 19	Pvt COTS Cp Lee Va; 15 F 19 2d Lt USR Inf Inactive Duty
Barnes, Louis D	'12	1 D 17 to 27 Au 19	1st Lt Med Corps 16 Ja 18 MOTC Ft Oglethorpe Ga; 11 Mr 18 58th Inf Cp Wadsworth SC; 3 S 18 55th Inf Newport News Va 28 S 18 Brest France; 3 N 18 Base Hosp Bordeaux France; 17 D 18 Cp Merritt NJ; 2 My 19 Capt
Barnes, Morris H	*CE* '18		EROTC Cp Lee Va; 2d Lt Engrs NA France
Baron, Edward V	*CE* '10	N 18	Capt Engrs; USR Inactive Duty
Barrios, Manuel J Jr	'14		Ensign USNRF
Barton, John A	'21	1 O 18 to 15 Ja 19	Inf OTS Cp Lee Va; 2d Lt Inf RC Inactive Duty
Bassett, Harold R	*CE* '19	7 Jl 18 to 11 D 18	Pvt 22d Engrs; 30 Au 18 EOTS
Bassett, Herbert H	*CE* '02	21 F 18 to 10 S 19	Major Engrs Constr Div
Bates, Carl A	*CE* '13	2 S 17 to 28 Jn 19	1st Lt Engrs; 6 Ap 19 Capt Engrs; 1 Ja 18 33d Engrs
Batjer, Henry H	*CE* '17	8 My 17 to 8 S 19	1st EOTC; 15 Au 17 2d Lt 5th Engrs Corpus Christi Tex; 12 My 18 1st Lt 5th Engr 26 Jl 18 AEF; 23 Au 18 Capt 5th Engrs; 25 F 19 Cp Humphreys Va
Battie, Herbert S	'13	17 to 19	1st Lt Engrs Ft Leavenworth Kan Cp Devens Mass & France
Baum, John A	*CE* '05	9 O 18 to 16 D 18	Capt Engrs Ft Benjamin Harrison Ind

Beach, Earl F ....'22...........................O 18 to D 18
SATC CU

Beakes, Charles C ....*CE* '16...................15 Ap 18 to 9 O 18
Av Cp Waco Tex; Pvt Meteorological Det SC College Sta Tex; 21 S 18 France; Died 9 O 18 France

Beale, Arthur W................*CE* '13.....Jn 16 to Mr 17 & Jl 17 to 30 Mr 19
Cpl 1st NY Cav Mc Allen Tex; 23 F 17 Sgt; Mr 17 Disch; Jl 17 1st Lt FA NYNG Rochester N Y; S 17 CO Co 6 Am Train 27th Div Cp Wadsworth SC; 1 Mr 18 Capt NG US 102d Supply Train 27th Div; 21 Jl 18 CO Motor Reception Park Marseilles France; 1 N 18 27th Div AEF

Beale, David ....*CE* '17................12 My 17 to 2 Ja 19
1st ROTC Madison Barracks NY; 25 Jn 17 Ft Monroe Va; 30 D 17 2d Lt 1st Lt Capt & Major 51st Art CAC France

Bear, Burnett ....'22........................22 O 18 to 7 F 19
2d Lt Heavy Art Ft Monroe Va

Bechel, Charles H ....*CE* '15.........................
Cand 4th ROTC Cp Mead Md; 2d Lt FA Cp Taylor Ky

Beck, Charles S ....*CE* '17.....................Ap 17 to 20 Au 19
19 Jn 17 2d Lt 26th Engrs AEF; U of London

Bedell, John R ....'18...........................S 17 to 6 O 19
Sgt 301st Engrs Cp Devens Mass; 5 My 18 4th EOTC Cp Lee Va; 25 My 18 2d Lt 61st Engrs (Ry) France; 5 My 19 1st Lt Engrs; Awarded Certificate for Especially Meritorious Service

Behrman, I Ellis................*CE* '10....................8 Ap 17 to 4 S 19
23 Jn 17 1st Lt 26th Engrs; O 17 Capt France; 4 S 19 Major

Beitz, William E ....*CE* '13........................Ap 17 to date
2d Lt 1st Lt Capt 14th FA Ft Sill Okla; Capt 1st Art France and Germany

Bell, Adie K ....'11...........................
2d Lt ORC

Bellinger, Lyle F ....*CE* '87............Jl 98 to My 99 and '01 to date
Capt 3rd US Vol Engrs Spanish War; 1901 Civ Engr USN; Now Lt-Cmdr

Bemis, Lloyd E ....*CE* '19.........................O 18 to D 18
SATC C U

Benedict, Horace G ....'18......................7 Ap 17 to 20 Ja 19
Smn 1st Cl USNRF Newport RI & New London Conn; 8 O 17 US N A; F 18 MIT Boston Mass; Mr 18 Bay Shore N Y; My 18 Pensacola Fla; Jl 18 Ensign (Pilot); S 10 Moutchic-Lacanan & Arcachon France; 27 D 18 Bay Shore NY

Benisch, Henry J ....'20..........................O 18 to D 18
SATC C U

Bennett, Rowland K ....*CE* '16..................24 S 17 to My 19
CACTS Ft Monroe Va; D 17 2nd Lt CAC Ft Totten NY; Jn 18 Ft Schuyler NY; S 18 74th Art France; D 18 Ft Totten N Y

Bennett, Ralph S ....'20.........................My 17 to Ja 19
2nd Lt Instr in Musketry Madison Barracks N Y; Au 17 Cp Perry O; F 18 Tr to Aviation Inspection

Benson, C Beverly ....*CE* '17 13 My 17 to 18 Jn 17 & 10 S 18 to 21 D 18
OTC Madison Barracks NY; 18 Jn 17 Disch Phys Disability; 10 S 18 1st Lt AS Instr USSMA CU Ithaca N Y

Benson, Orville.................*CE* '88...................23 Jn 17 to 7 O 19
Major Engrs 27 O 17 Overseas; 8 N 17 Transp Dept; 1 Jl 18 Ch Engr Ry Art; Slightly gassed in St Mihiel Salient

Benson, Walter V .... *CE* '17 .... 3 Ja 18 to 24 Jl 19
Land Electrician 3rd Cl; 1 Jn 18 Electrician 2d Cl; Ch Electrician US Submarine Base New London Conn.

Bermel, Peter E .... *CE* '15 .... 14 My 17 to ———
11 Jn 17 2d Lt 303d Engrs; 4 My 18 1st Lt Engrs NA; 17 Jl 18 Capt Corps Engrs; 28 O 18 Instr 2d Corps Sch France

Bernard, William S Jr .... '22 .... O 18 to D 18
SATC C U

Bernstein, Max .... *CE* '16 .... 26 O 17 to 6 N 19
2d Lt 36th Inf Ft Leavenworth Kan 19 Mr 18 1st Lt Ft Snelling Minn; Mr 19 Cas France; Au 19 Cp Devens Mass

Bird, Matthew M .... *CE* '12 .... 2 S 17 to 26 Jl 19
Capt 507th Engrs Cp Travis Tex and France

Birkin, Kenneth W .... '18 .... 26 My 17 to ———
Am Fld Ser in France; Dis D '17; Re-enl; 1 yr in French Army TM Ser; 1 yr US Army; D 18 2d Lt MTC Det 2 Cp Meys DC

Blakelock, David H .... '17 .... Jn 16 to date
Capt 17th Cav Border Ser; S 18 Major Schofield Barracks Honolulu TH

Blinn, Thomas W .... *CE* '12 .... My 17 to Ja 18
S 17 Capt Engrs

Bliss, Clarence R .... *CE* '11 .... 6 O 17 to 18 S 19
Pvt Inf Cp Devens Mass; 1 N 17 Corp; 3 My 18 Stu Cand (E)OTS Cp Lee Va; 16 My 18 Off Stu (E)OTS; 28 My 18 2d Lt 308th Engrs France and Germany; 5 D 19 1st Lt ERC Inactive Duty

Blog, Leon .... *CE* '15 .... 10 O 17 to 22 Ja 19
Pvt Inf Cp Upton NY; 30 D 17 Pvt Corp & Sgt 1st Army Hdq; 1 Au 18 Saumur Art Sch; 1 N 18 Stu Angiers France; 2d Lt CAC

Blundon, Joseph P .... *CE* '17 .... 2 Jl 18 to 11 D 18
Pvt Engrs Washington Barracks Washington DC; 20 Au 18 (E)OTS Cp Humphreys Va; 27 N 18 2d Lt Engrs USA

Bobker, Harry .... *CE* '18 .... S 18 to D 18
CA OTS Ft Monroe

Boesch, Clarence E .... *CE* '06 .... 13 S 16 to 21 Jn 19
Capt N C Engrs Texas Border Ser; CO Dist 2 N C; 17 S 17 Capt 105th Engrs Cp Sevier S C & France; 5 O 18 Genl Staff College Langres France; 18 Ja 19 Hdq 89th Div; 12 My 19 Major Engrs Asst Chf Staff G-I 89th Div Germany

Bolger, Edwin G .... *CE* '13 .... 1 Jn 18 to 15 My 19
Cadet USSMA C U Ithaca NY & Barron Fld Texas; 2d Lt AS Pilot (RMA)

Bonagura, Alphonse .... '19 .... My 18 to Ja 19
Pvt 472d Engrs Wichita Falls Texas Topographic Work

Bonner, John P .... *CE* '12 .... 25 Au 17 to D 18
FAOTC Ft Monroe Va; 25 N 17 Capt CAC France; O 18 Instr Cp Eustis Va

Booth, Raymond .... *CE* '10 .... 28 D 17 to 19 Au 19
1st Lt 54th Engrs (Ry Optg) Cp Lee Va and France

Borelli, Tomas .... '21 .... 25 F 18 to 1 My 19
Pvt 128th FA Fort Sill Okla and France 4 Major Optns

Bowles, Albert M .... *CE* '14 .... My 17 to Jl 19
(E)OTS Ft. Leavenworth Kan; Au 17 1st Lt 315th Engrs Cp Travis Texas; Ap 18 Capt; Jn 18 France; Jn 19 Cp Bowie Texas

Bowles, Robert B .... '19 .... O 18 to F 19
Cp Taylor Ky; 29 Ja 18 2nd Lt FA

Bowman, Charles C Jr .... '17 .... Jn 17 to — — —
45th Bgde E; Norton-Harges Red Cross Un; Tr Br French Air Ser; Stu Fontainbleau; Aspirant Foreign Legion 32d Reg Art; Received Croix de Guerre; Rec for Prom

Brady, Samuel D jr .... '21 .... 1 O 18 to 15 D 18
SATC C U

Braunworth, Percy L .... *CE* '06 .... 1 S 17 to 28 Ja 19
Capt Engrs; Maj Engrs; Supt of Roads BS 2; Btn Cmdr 135th Engrs Staff; Div Const & For

Brayman, Eugene .... '21 .... O 18 to D 18
SATC C U

Breneman, Joseph T M .... '16 .... 15 My 17 to 18 F 19
11 Au 17 2d Lt 6th Rgt; 1st Lt 51st Art France

Brewster, Oswald C .... '18 .... 28 Au 17 to — —
Am Fld Ser with French Army 8th Div; Section twice decorated with Croix de Guerre; Awarded Croix de Guerre

Briggs, Chauncey M .... *CE* '17 .... 15 Au 18 to 5 D 18
Ensign USNRF Bur of Ord Washington D C

Brodt, Burton W .... *CE* '14 .... 8 My 17 to 20 Ja 19
ROTC Ft Sheridan Ill; 2nd Lt 329th FA; My 18 1st Lt FA Sch of Fire Ft Sill Okla Instr

Bronson, Frank P .... '11 ....
Capt CAC USR France and Cp Eustis Va

Bronson, Howard F .... *CE* '10 .... 9 D 17 to 14 Au 19
Capt San Corps; Cp San Engr Cp Upton NY

Brooks, Landon M.............. *CE* '14 .... Jl 18 to — — —
1st Lt USR Cp Travis Tex

Brower, Gerald E .... *CE* '16 .... 30 N 16 to date
Prov 2d Lt RA; 19 Ja 17 Prov 1st Lt RA; Mr 17 8th FA; 5 Au 17 Temp Capt RA; N 17 17th FA; 15 Ap 18 Prov Capt RA 19th Engrs; Au 18 5th FA; O 18 2d AIS 2d CAS 5th AAOS; My 19 1st Aero Sqdn; Cp Grant Ill

Brower, Irving C .... *CE* '01 .... 18 My 18 to date
Capt & Maj Constr Div QMC Cp Custer Mich and Washington DC

Brown, John W .... *CE* '12 .... 28 Ja 18 to 16 D 18
Pvt MG Cp Hancock Ga; 12 Au 18 Pvt Ord Det 26th CAC Cp Stuart Va

Brown, Morris E .... *CE* '12 .... 4 Au 17 to 7 Mr. 19
1st Lt AS Constr Cp Alfred Vail N J

Brown, Nathaniel A .... *CE* '03 .... 24 O 18 to — — —
1st Lt San Engr School Cp Greenleaf Ga; 15 D 18 Taliaferro School Ft Worth Tex

Buchanan, George P .... *CE* '14 .... 26 S 18 to 12 Ap 19
Corp Unassigned

Buck, John A .... *CE* '15 .... 23 Mr 18 to 19 S 19
Pvt 32d Engrs; 25 My 18 2d Lt 319th Engrs Cp Fremont Calif

Buehler, Albert G. F .... *CE* '11 .... 1 N 17 to 1919
1st Lt; Capt; Ord Dept Insp Detroit Mich and Dayton Ohio

Bullard, George P .... *CE* '18 .... O 18 to D 18
SATC C U

Bunn, Charles H jr .... *CE* '17 .... 12 Jn 17 to 10 D 18
Amer Fld Ser (French Army); 2 Ja 18 Pvt French Army TMU 526; 2d Lt USA 121st FA; 1st Lt 32d FA; Instr Cp Meade Md

Burdick, Roy D .... *CE* '14 .... 9 Jl 16 to date
Sgt Co B Ohio Engrs; 2 O 17 1st Lt CAC; 12 D 17 Capt CAC; 27 O 18 27th CAC; Ft McKinley Me; Fr Kamehaha TH

Burgard, Willard H .... *CE* '16 .... Jl 18 to — — —
Engrs USR

Burke, Walter R .... '18 .... 12 My 17 to 18 O 18
18 Au 17 2nd Lt Cp Dix NJ; 19 Au 17 1st Lt Cav 107th MGBtn Ft Hancock Ga; 329th Inf Cp Sherman O; 322–3 FO Cp Sherman O; MG Tr Center Ft Hancock Ga

Burns, Samuel .... '20 .... O 17 to O 19
Pvt 301st Engrs France and Germany

Burrage, John D .... *CE* '14 .... N 17 to D 18
Pvt and 1st Cl Sgt 58th 202d 677th and 502d Aero Constr Sqdns; Au 18 EOTS; N 18 2d Lt 153d Engrs

Burton, Frank H .... *CE* '13 .... 5 Ja 18 to 14 My 19
Pvt 1st Cl OTC Cp Upton N Y; 25 Ja 18 2d Lt 65th Engrs; 5 Ap 18 327th Btn TC; 4 Jn 18 1st Lt; 12 O 18 France

Burton, James T .... *CE* '14 .... D 17 to 17 Jn 19
Pvt 23d Engrs; Mr 18 Corp France

Bush, Harold W .... '21 .... S 18 to D 18
Pvt CAS Ft Monroe Va

Bush, Howard J .... '20 .... — — — to 5 S 18
USNRF Died in service at Newport R I 5 S 18

Butchers, Earl B .... *CE* '01 ....
Capt 22d Engrs France

Calloway, Robert W .... '22 .... O 18 to D 18
Sgt SATC C U

Campbell, John B .... *CE* '14 .... 12 My 17 to 12 My 19
Pvt Corp 2d Lt 1st Lt 19th Engrs (Ry); 26 O 18 116 Engrs 41st Div; 21 D 18 316th Engrs 91st Div; 18 Ap 19 Corps of Engrs USA

Canfield, Harold T .... *CE* '13 .... 5 Ja 18 to 18 Mr 19
Pvt Corp Sgt 304th FA; 20 Jl 18 2d Lt Art 1st Army; 20 O 18 1st Lt 54th Art

Cary, Matthew L .... *CE* '15 .... 24 Au 17 to 19 F 19
Capt QMC Tr Off Cp Dix NJ; My 18 Ch QM BS No 3 London England; Jl 18 Cp QM Am Rest Cp Liverpool Eng

Carlin, Jospeh P .... *CE* '97 .... 23 O 18 to 4 Ja 19
Capt Major Ord Dept Admn Div Washington DC

Carson, Richard B .... *CE* '14 ....
308th Engrs Cp Sherman O

Carter, Lorraine W .... '23 .... O 18 to D 18
SATC CU

Casey, James VSH .... '21 .... O 18 to D 18
SATC C U

Caves, Stuart S .... *CE* '16 .... 11 My 17 to 5 Jn 19
15 Au 17 2nd Lt 1st T C Ft Niagara NY; 11 F 18 1st Lt Cp Meade Md; 7 Mr 18 Capt 304th Div Supply Train 79th Div France; Cited G O No 29 Hdq 79th Div

Chadeayne, Henry F .... *CE* '18 .... 13 Au 18 to 3 D 18
Pvt FACOTS Cp Taylor Ky; 4 D 18 2nd Lt FARC Inactive Duty

Chamberlain, Basil M .... '90 ....
Maj Ord RC Insp of Ord Willis-Overland Co Toledo O; Tr to Cleveland as Spec Asst to the Dist Claim Board

Chase, George A jr .... *CE* '14 .... 30 Au 18 to 24 D 18
Pvt 472d Engrs Washington DC; 1 O 18 Pvt 1st Cl 472d Engrs Hdq Det Computer; 1 N 18 Corp

Chavanne, John J jr .... '21 .... O 18 to D 18
SATC C U

Cheston, James H .... '21 .... S 18 to D 18
SATC C U

Child, John T .... *CE* '12 .... 25 My 18 to 25 Ja 19
Pvt 153d Depot Brigade Cp Dix NJ; 13 Jn 18 2nd Lt San Corps Cp Greenleaf Ga & Cp Meade Md; 16 N 18 1st Lt San Corps; 20 N 18 CO Det

Chirlian, Gustave .... '21 .... O 18 to D 18
SATC C U

Chobot, Edwin F .... '21 .... O 18 to D 18
SATC C U

Christ, Leone L .... '19 ....
Enl Boston

Christ, Leslie R .... '22 .... O 18 to D 18
SATC CU

Christensen, Eiler M .... '20 .... 8 S 17 to 10 S 19
Pvt Inf Cp Dix NJ; 20 Mr 18 Sgt 310th Inf France; 15 Mr 19 2nd Lt 30th Inf 3rd Army France and Germany

Christensen, Walter C .... '21 .... O 18 to D 18
SATC C U

Christie, J G Carlisle .... *CE* '14 .... 27 Au 17 to 28 Ja 19
8 N 17 1st Lt AS 639th Aero Sqdn; 22 D 17 505th Aero Sqdn

Cianchini, Luis F .... *CE* '16 .... 17 Jn 17 to date
1st Lt P R Inf Cmdr MG Co Empire CZ and San Juan PR

Cissel, H H .... '22 .... O 18 to D 18
SATC C U

Clapp, Robert V .... '20 .... 25 My 18 to 24 D 18
Plattsburg Bks NY; 16 S 18 2d Lt Inf Unattached

Clark, Lester P .... *CE* '17 .... Jn 18 to Ja 19
2nd Lt 4th ET Rgt Cp Humphreys Va; 211th Engrs Cp Meade Md

Clark, Otho M .... *CE* '14 .... 15 Au 17 to 30 D 18
2d Lt EOTC Ft Leavenworth Kan; 26 N 17 Engr Repl Troops; 25 Mr 18 4th Engrs; 3 Jl 18 Adj West Cantonment Ft Benjamin Harrison Ind; 30 Jl 18 1st Lt; 4 N 18 Capt France

Clay, Leon G .... '20 .... 9 O 18 to 24 D 18
CACOTS Ft Monroe Va; 2d Lt USR Inactive Duty

Cleveland, Lou B .... *CE* '07 .... 1 O 17 to 4 Ap 19
1st Lt 105th Engrs Joint Army and Navy Airship Board; Trnsptn Corps Office of Chf Engr 2nd Army 26th Engrs

Cobb, William G G .... '22 .... O 18 to D 18
FAROTC Cp Taylor Ky; Cand Off

Cochran, Thomas F .... '19 ....
Ensign USNRF New Orleans La

Cockcroft, Donald G .... '21 .... 7 Ap 17 to 24 Mr 19
Smn USNRF Tr Cp Newport RI; 7 Ja 18 Electn Hydrophone Ser No Sea & Engl Channel; 7 Ja 19 Ensign Hydrophone Ser Research New London Conn

Coffey, Phillip T .... *CE* '14 .... 12 My 17 to 19 Jn 19
5 S 17 Capt 25th Engrs

Coggins, Charles P .... '18 .... N 17 to Mr 19
Flying Cadet USSMA Princeton NJ; O 18 2d Lt RMAAS (A) Barron Fld Texas and Rockwell Fld Calif

Cohen, Abraham .... *CE* '11 .... 22 Au 17 to 2 S 19
2d Lt Engrs USA 322d Motorcycle Co

Cohen-Contin J .... '20 .... O 18 to D 18
SATC C U

Collett, Walter J .... *CE* '15 ....
1st Lt CAC Ft Monroe Va and Ft Samesa mesa TH

Collum, Thaddeus L Jr .... '20 .... O 18 to D 18
SATC C U

Conant, Frederic W .... *CE* '14 .... 5 Au 17 to date
Pvt 144th FA; 27 N 17 2d Lt 63d Inf Presidio Calif; 8 Jl 18 2d Lt Engrs; 19 Jl 18 Capt Engrs Cp Humphreys Va; 21 D 18 9th Engrs (Mtd) Cp Courchesne Texas

Conger, Walter C .... *CE* '12 .... 28 Jl 17 to 22 Ja 19
1st Lt MTC Rep Un 315 San Antonio & El Paso Tex

Conkling, Frank E .... '22 .... O 18 to D 18
SATC C U

Constans, Frank S .... *CE* '19 .... 1 Jn 18 to 11 D 18
Smn 2d Cl USNRF Chicago Ill; Au 18 Syracuse N Y; S 18 SATC C U

Conwell, Walter L .... *CE* '11 .... 13 My 17 to 12 Jl 19
Pvt Madison Barracks NY; 1 Jn 17 1st Lt Inf; 15 Au 17 Capt & Adj 307th FA 78th Div Cp Dix NJ; 24 F 18 Major; 8 My 18 France; 16 N 18 76th FA 3rd Div Ger; F 19 307th FA; Mr 19 Det Ser AEF Univ Beaune France; Supt Bldg & Grounds

Cook, Charles F .... *CE* '06 .... Jl 17 to 1 Ja 19
Major Ord Dept Awarded DSM for Exceptionally Meritorious & Distinguished Service; Died of Influenza, 1 Ja 19

Cook, James R .... O 18 to D 18
SATC C U

Cooman, Carl C .... *CE* '15 .... 3 Jn 18 to 6 Mr 19
OTC Cp Greenleaf Ga; 3 Au 18 2d Lt San Corps CO SC Det Cp Shelby Miss; 15 Ja 19 Asst Cp San Engr Cp Sheridan Ala

Cooper, James A Jr .... *CE* '16 .... 12 D 17 to 13 D 19
Smn USNRF; 1 Ap 18 QM 3d Cl; 10 Au 18 Ensign

Copeland, Dwight L .... '22 .... O 18 to D 18
SATC C U

Corbet, Clinton L .... *CE* '15 .... 1 O 17 to 4 Ap 19
2d Lt AS Champaign Ill, Rich Field, Post Field, Ft Sill Okla, Taliaferro Field Fla, Ft Worth Tex; O 18 AEF

Cormack Charles M .... '20 .... O 18 to D 18
Corp SATC C U

Corney, Blair .... '22 .... O 18 to D 18
SATC C U

Cory, Harry T .... *CE* '93 .... 19 Ja 17 to 5 D 17
Major EORC

Courtney, John H .... *CE* '17 .... 13 My 17 to 15 D 18
1st OTC Madison Barracks N Y; 13 Au 17 2d Lt 312th Inf Cp Dix N J; 16 Mr 18 1st Lt 312th Inf AEF; 16 O 18 Staff 96th Div Cp Wadsworth SC Bayonet Instr

Cozzens, Arthur B .... *CE* '13 .... 17 Ja 18 to 31 Ja 19
1st Lt Ord Dept

Crandall, Carl .... *CE* '12 .... 16 F 18 to 31 D 18
USSMA C U Ithaca N Y; 20 Ap 18 Cp Dick Tex; 25 My 18 Dorr Field Tex; 25 Au 18 Barron Field Tex; 22 S 18 Brooks Field; 31 D 18 2d Lt RMA AS

Crook, Clement E . . . . *CE* '16 . . . . 28 S 17 to 15 Ja 19
2d Lt EORC

Croxton, Albert M . . . . '21 . . . . 20 My 18 to 23 Ap 19
Ensign Naval Aviation

Crusel, Cornelius C . . . . '22 . . . . O 18 to D 18
SATC C U

Cudebec, Albert B . . . . *CE* '08 . . . . 17 to 19
Major Engrs AEF Gen Staff Charge of Elect Power Transmission throughout region of supplies during entire war. Awarded Order Chevalier of the Legion d'Honneur (France)

Cuff, James E . . . . *CE* '12 . . . . 25 Au 17 to 20 Ja 19
OTC Ft Niagara NY and Ft Monroe Va; 27 N 17 2d Lt CO 2d Btn Gas Div CWS; 20 Jl 18 1st Lt; 15 O 18 Capt Engr in Charge of RR Dock & San Constr Poison Gas Plant Edgewood Md

Curlbertson, William J . . . . *CE* '15 . . . . 21 O 18 to 11 Au 19
2d Lt Util Dept Cp Eustis Va; 6 Ap 19 USA Gen Hosp No 21

Cummings, Edward . . . . *CE* '17 . . . . 12 My 17 to 6 O 19
1st OTC Madison Barracks N Y; 15 Au 17 2d Lt 15 FA 2d Div; 6 F 18 1st Lt; 12 S 18 Capt; Was decorated twice with Croix de Guerre and had 3 Div Citations

Dailey, Bernard C . . . . *CE* '17 . . . . 23 Au 17 to Date
2d OTC Plattsburg Barracks NY; 27 O 17 2d Lt 58th Artillery Ft Monroe Va; 15 D 17 Ft Totten NY; 8 My 18 Temp 1st Lt 23 My 18 France; 23 Au 19 1st Lt CAC Instr Heavy Art Fire Ft Monroe Va; 1 O 19 Ft Mills P I; 1 Ja 20 CO 17th Co Mobile Art

Daly, John W . . . . *CE* '12 . . . . 23 Au 17 to 2 Mr 19
Inf Tr Cps at Leon Springs Tex & Cp Lee Va; 164th Inf AEF; 27 N 17 2d Lt Inf; 10 S 18 1st Lt Inf

Danforth, Thomas F . . . . *CE* '15 . . . . 16 Jn 18 to 5 Mr 19
Pvt Engrs Tr Rgt Cp Humphreys Va

Daniels, Francis W . . . . '20 . . . . 7 Ap 17 to 12 D 18
BM 2d USNRF Newport RI and New London Conn

Daniels, James M jr . . . . '01 . . . .
Capt Adj 1st Btn 113th Rgt

Daniels, Olin R . . . . '22 . . . . O 18 to D 18
SATC C U

Daniels, Percy N . . . . *CE* '15 . . . . 13 Au 17 to ———
Pvt CAC OTC Ft Meyer Va; 11 S 17 1st Lt San Corps; O 17 San Co 1 Ft Oglethorpe Ga; F 18 San Engr Cp Gordon Ga; Au 18 San Engr Cp Custer Mich; N 18 Capt CO San Squad 121 Cp Crane Pa; D 18 San Engr Cp Travis Texas

Dargue, Daniel L . . . . '19 . . . . 11 Jl 17 to 23 Jl 19
Pvt 1st Cl SERC Stu Toronto Can; 26 O 17 2d Lt Instr USSMA C U Ithaca N. Y; 25 N 18 Instr USSMA Univ of Tex; 13 Ja 19 2d Lt RMA In charge Cadets Gunnery Traffic Carrier Pigeons & Forest Fire Patrol March Fld Calif

Darrow, Warren E . . . . *CE* '07 . . . . 1 My 17 to Au 19
1st Lt Engrs; 1 Ja 18 Capt 45th Engrs & 7th Co TC 4 Ja 19 CO Cp 6 Base Sec No 1 AEF; Letter of Commendation Cp 6 From CO US Troops St Naziare France

Darville, Merton A . . . . *CE* '12 . . . . 2 S 17 to 22 Ja 19
2d Lt USR 25th Engrs 26th Div & 116th Engrs 41st Div AEF

Davall, Harold J . . . . '01 . . . . 27 Jl 18 to 4 D 18
Capt EOTC Cp Humphreys, Va; 2 O 18 3d Engr Tr Rgt; 4 N 18 Survey Off; 11 N 18 3d Engrs 2d Rgt

Davey, Otis . . . . '13 . . . . Ap 17 to 2 D 18
N 17 1st Lt Instr Cp McLellan Ala; 29th Div France rec for Capt; 2 D 18 Died of pneumonia at Jussey France

Davis, Benjamin V B . . . . '17 . . . . 15 My 17 to 22 Ja 19
OTC; 15 Au 17 2d Lt USR 302d Inf Cp Devens Mass; Jn 18 Act Adj of Btn Act Personnel Off; 4 Jl 18 France

Davis, John C . . . . *CE* '00 . . . . 8 My 17 to 26 D 18
OTC; 15 Au 17 CATS Ft Monroe Va; 5 N 18 Capt 40th Rgt CAC; 18 F 18 Major CARC

Davis, R Menees . . . . *CE* '07 . . . . D 17 to My 19
1st Lt Stu EOTC Petersburg Va; Ap 18 Adj Cp Laurel Md; Jn 18 Capt 57th Engrs; Au 18 France; O 18 Supt of Port of Ville-Neuve-Le-Roi France

Davison, Lester . . . . '22 . . . . Au 18 to Jn 19
Stu Off NAS; N 18 Maimi Fla; F 19 Pensacola Fla

Dawson, Francis M . . . . *MCE* '13 . . . . F 15 to 26 Ap 19
Canadian Army 15th Btn OMFC; 17th Res Btn; Capt & Adj Canadian Engrs; Jn 18 Mentioned in despatches; D 18 Awarded Military Cross

Day, Harold . . . . '17 . . . . 12 N 17 to Mr 20,
Pvt 1st Cl and Corp 127th Engrs Mtnce France

Day, Warren E . . . . *CE* '10 . . . . 28 D 17 to 13 Au 19
Capt ETC Instr Cp Lee Va; 10 Ap 18 45th Engrs; 16 D 18 Trans Corps; 1 Yr Cp Montoir France

Deagon, Arthur . . . . '21 . . . . O 18 to D 18
SATC C U

Dean, Barclay D . . . . '22 . . . . O 18 to D 18
SATC C U

Dean, Carl E . . . . '22 . . . . O 18 to D 18
SATC C U

DeCarre, Octave . . . . *CE* '11 . . . . '11 to date
Lt Capt & Major CAC

DeGarmo, Robert M . . . . *CE* '09 . . . . 21 Jl 17 to 12 Ap 19
1st Lt 17th Engrs (Ry) France; 28 F 18 Capt; 4 F 19 Major

Degling, Albert O . . . . '20 . . . . O 18 to D 18
SATC C U

DeLaMater, Stephen T . . . . '00 . . . . 24 O 18 to date
Capt QMC Constr Div

Demarest, John McL . . . . *CE* '14 . . . . Jn 17 to Jn 19
2d Lt 25th Engrs; 5 N 18 1st Lt; Received regimental citation for work in the Argonne-Meuse operations

DeWitt, Earl S . . . . '19 . . . . My 17 to Au 19
1st OTC Madison Barracks N Y; 2d Lt 1st Lt 109th FA 28th Div Cp Hancock Ga; Aerial Observer France

DeWitt, John . . . . *CE* '17 . . . . Jl 18 to date
Av Sec Signal Corps France

Dickens, Wayland . . . . *CE* '09 . . . . 14 My 17 to 21 Jl 19
OTC; S 17 1st Lt 301st Engrs; D 17 507th Engrs; Ap 18 20th Engrs

Dickerson, George M . . . . '23 . . . . O 18 to D 18
SATC C U

Dickinson, Julius A. . . . . '17. . . . .
1st Lt 17th Engrs (Ry)

Dickinson, William E. . . . . *CE* '14. . . . . Jl 18 to ——
Pvt USR Engrs Cp Lee Va; 2d Lt

Dillard, William R. . . . . *CE* '17. . . . . My 17 to S 19
1st Sgt 17th Engrs (Ry); S 18 2d Lt; N 18 1st Lt; BS No 1 France & German Austria

Dimijian, Aran H. . . . . *CE* '18. . . . . 8 N 17 to 26 Au 19
Pvt Depot Det 419th Engrs; 26 D 17 Master Engr Jr Gr; F 19 Master Engr Sr Gr France

Distler, Walter G. . . . . *CE* '13. . . . . 13 F 18 to 5 My 19
Capt QMC Constr Div 26 Jl 18 Const QM Cp Humphreys Va; 26 S 18 Major

Dittrich, John A. . . . . *CE* '14. . . . . 21 Au 17 to 15 D 18
2d OTC Plattsburg N Y; 29 N 17 1st Lt Coast Defenses Boston Mass; 1 Au 18 Capt 33d CAC Cp Eustis Va

Doane, Edwin G. . . . . '14. . . . . 27 Au 17 to 23 D 18
2d OTC Ft Oglethorpe Ga; 13 N 17 2d Lt AS; 25 N 17 125th Aero Sqdn; 15 Mr 18 3d Constr Co Einsworth England

Dodson, Richard S. . . . . *CE* '08. . . . . 26 My 10 to date
2d Lt CAC; 31 D 13 1st Lt; 15 My 17 Capt 8th FA; 20 My 18 Major 303d FA France; 26 O 18 Lt Col; 5 Ja 19 Ad Gen 9th Army Corps; 5 Mr 20 Manila P I

Doebler, Errol W. . . . . *CE* '15. . . . . 10 D 17 to 29 Mr 19
Sgt 1st Cl QMC Constr Div; 14 My 18 2d Lt Asst to Off in Chg of Utilities Cp Dix N J; In Chg of Sewers & Sewage Disp

Dole, Walter S. . . . . *CE* '92. . . . . 27 S 18 to date
Capt Constr Div Cp Fremont Calif Cp Beauregard La Cp Holabird Md

Donaldson, John O W . . . . '20. . . . . 17 to date
18 2d Lt AS; 19 1st Lt; 20 Capt American and British Ace; Decorated by British with the Distinguished Flying Cross; Taken prisoner about 1 S 18 and escaped about the middle of O; Officially credited with 8 Hun planes; Recommended for British Distinguished Service Medal; Four Citations for Gallantry

Donnellan, George P. . . . . *CE* '10. . . . . 11 My 17 to 5 Jn 19
OTC; Au 17 1st Lt 307th Engrs; My 18 France In St Mihiel & Meuse-Argonne; N 18 Capt 307th Engrs

Doores, William R. . . . . *CE* '93. . . . . 9 Jl 98 to date
2d Lt 5th Art; 01 1st Lt; 03 Capt; 16 Major; 17 Lt Col; 18 Col 5th Art P R Campaign & Post Service US PR & Pl

Dornbach, Earle E R. . . . . *CE* '15 . . . .
Sgt Hdqt Co 309th Inf France; 303d Engrs

Douglas, P Gordon. . . . . *CE* '06. . . . . Jl 18 to date
Capt British Royal Engrs

Dow, Burton C. . . . . '22. . . . . O 18 to D 18
SATC C U

Dow, Hezekiah S . . . . *CE* '15. . . . . 12 N 17 to 17 Ja 19
2d Lt A S; N 17 492d Constr Sqdn A S AEF; Jn 18 Div of Constr & For Hdq SOS AEF; N 18 1st Lt Engrs Hospital Constr Tours France

Doyle, Hobert E. . . . . *CE* '12. . . . . S 18 to ——
Cp Johnston Jacksonville Fla

Drake, Frederick L. . . . . '18. . . . . 12 My 18 to 10 N 18
OTC; 15 Au 17 2d Lt USR 311th Inf Cp Dix N J; 1st Lt Btn Hdqt Scout & Int Sec 158th Btn 311th Inf AEF; 10 N 18 Died of Wounds at Vichy France

Drechsler, Meyer.............. ..'15..............................
Pvt 301st Engrs AEF

Driscoll, James F.... ....*CE* '17................15 My 18 to 22 D 18
FAOTC Cp Taylor Ky; 31 Au 18 2d Lt 71st FA

Duffies, Edward L...............'19......................Ja 18 to 17 My 19
3d OTC 1st Cl Pvt Cp Upton N Y; Ap 18 Sgt 305th FA; My 18 Saumur Art Sch France; 12 Jl 18 2d Lt FA; Au 18 323d FA; S 18 308th FA; In St Mihiel & Argonne-Meuse Offensives

Duncan, Daniel T.... ....*CE* '18.......................D 17 to My 19
Smn 2d Cl USNRF; Ensign USN Tr Ship USS Henderson

Dunn, Albert C.... ....*CE* '14................10 My 18 to 21 D 18
Pvt Hdq Det Supvg Constr M G Range Cp Hancock Ga

DuPré, Wallace D.... ....*CE* '13..................I O 17 to 26 Jn 19
2d Lt 303d MTC; 1 S 18 1st Lt; Cited for exceptionally Meritorious & Conspicuous Services in France

Ecker, Andrew E.... ....'22..........................O 18 to D 18
SATC C U

Eddy, Allerton.................'20....................1 Au 18 to 21 F 19
Pvt 216th Engrs EOTC Cp Humphreys Va; 1 N 18 Cp Kearney Calif

Edmunds, Robert C.... ....*CE* '18..................15 My 18 to 15 D 18
FAOTS Cp Taylor Ky; 2d Lt FA

Ehlers, Joseph H..... ....*CE* '16.......................Jl 18 to 14 N 19
2d Lt Engrs

Eickelberg, Ernest W.... ....*CE* '13..................24 S 17 to 6 Jn 19
1st Lt CAC; 21 S 18 Capt CO US Army Mine Planter "Gen Wm M Graham" Panama C Z

Eilenberger, Charles F.... ......*CE* '16............................
OTC Ft Niagara N Y; Disch phys disq 2d Lt

Eisenbrandt, Alexander S.. .... .'20..........................O 18 to D 18
SATC C U

Eisenbrandt, Frederick H.......*CE* '18....................30 Au 18 to 10 Ja 19
FAOTS Cp Taylor Ky; 11 Ja 19 2d Lt FA USR Inactive Duty

Eisner, Benjamin ....'20......................... O 18 to D 18
SATC C U

Ellsworth, Goodwin D Jr........*CE* '10.......................D 17 to O 19
Lt (J G) CE C USNRF; Jl 18 USNAS Pub Wks "A" Sta Paimboeuf & Fromentine France; Jl 18 Hdq Paris; O 18 London Eng; Mr 19 Newport R I

Emerson, William H..... ......'20..........................O 18 to D 18
SATC C U

Engle, Samuel...... ....'20..........................O 18 to D 18
SATC C U

Eppleur, Charles Jr.............*CE* '17...................7 N 17 to 13 D 18
C M 1st Cl USNRF

Epps, Joseph E.................'20 ....
Ft Des Moines Ia

Evans, William H..... ....'22..........................O 18 to D 18
SATC C U

Eyrich, Harold R............ ..*CE* '14......................My 18 to Ap 19
Capt S C (AS) Constr; Major; Cited for DSM

Fackiner, Lester H..............'18........................12 My 17 to 5 Jl 19
Cand CAOTC Ft Hancock Ga; 2d Lt 1st Lt & Capt 74th Art Sandy Hook N J France & Ft Monroe Va

Fahey, Aloysius A.............. *CE* '14..........................
Sgt 14th Engrs (Ry) France

Fahy, Charles H................ *CE* '17....................12 My 17 to 1 Ja 19
Stu USN Torp & Tr Sch Newport R I; S 18 Ensign

Fairbank, Herbert S............ *CE* '10..................28 Ja 18 to 17 Ja 19
1st Lt Ord Edgewood Arsenal Md; Jl 18 1st Lt CWS; 25 O 18 Capt

Fanning, Winthrop C .... *CE* '16..................12 My 17 to 10 Mr 19
ROTC Ft Niagara NY; USSMA C U Ithaca N Y; Mineola N Y; Mr 18 2d Lt A S Gerstner Fld Cp Dick Tex Ft Sill Okla Selfridge Fld; D 18 168th Aero Sqdn AEF; 10 Mr 19 died of pneumonia at Chatillon-sur-Seine France

Farlin, Charles D.............. *CE* '13....................28 Jl 18 to 27 N 18
Pvt 212th Engrs; 26 S 18 EOTS

Farr, Louis R.................. '16......................15 My 17 to — —
1st FAOTC Ft Sheridan Ill; 25 Au 17 2d Lt FA; Ja 18 147th FA 41st Div AEF; Jn 18 1st Lt 57th FA 32d Div

Farr, Newton C................. *CE* '09..................13 D 17 to 17 Ap 19
Sgt; Sgt 1st Cl; 14 Mr 18 2d Lt AS

Fassett, Newton C.............. *CE* '04....................2 N 17 to 26 Ap 19
Pvt 1st Cl Sec 600 Amb Ser; Jl 18 Italy; S 18 France

Fay, Alfred L.................. '20......................28 Au 18 to 10 Ja 19
3d Rgt FA Cp Jackson S C; 30 O 18 Newport News Va; 28 N 18 Cp Jackson SC; 10 Ja 19 Cp Devens Mass

Feehan, Harry J................ *CE* '14....................29 S 17 to 26 Jn 19
302d Engrs; 2 Ja 18 EOTC; 1 My 18 2d Lt 304th Engrs; 1st Lt

Fein, Morris................... '22..........................O 18 to D 18
SATC C U

Feiner, Mark A................. *CE* '13..................21 Ap 18 to 22 Ap 19
Pvt SC; 21 D 18 Sgt Met Sec S C College Sta Tex

Feinson, Samuel H.............. '22..........................O 18 to D 18
SATC C U

Ferguson, George A............. *CE* '01..................19 Jn 17 to 1 My 19
Capt Engrs; 11 N 17 Supvg Engr Constr Div

Ferguson, James G.............. '20......................26 Ap 17 to 23 D 18
Nav A S Newport R I; Ensign Obs Balloon Pilot; Nav Avtr

Fertel, Arthur .... '20..........................O 18 to Mr 19
Pvt USMC Paris Island S C

Field, Arthur M................ *CE* '14....................21 Jn 18 to 13 D 18
Pvt CAC; 8 Jl 18 Cand OTC Ft Monroe Va; 25 S 18 2d Lt CAC Sch for Ortn Off Ft Monroe Va and Charlottesville Va; 5 N 18 Ortn Off 40th CA

Fields, Frank V .... *CE* '18....................5 My 18 to 25 Jl 19
Pvt 1st Cl EOTC; 1 Au 18 2d Lt 6th Engr Tr Rgt; 1 S 18 106th Engrs SOS Brest France

Fields, Leslie E............... '18......................14 O 17 to 12 Mr 19
Pvt 25th Engrs; Ja 18 Corp; 2 O 18 Wounded Argonne

Filby, Ellsworth L............. *CE* '17....................1 Jl 18 to 8 Ja 19
Pvt Surv Pty No 3 Det San Corps Cp Jackson S C; Corp; Sgt

Finley, David H................ '16 ....
Lt

Finn, Thomas D Jr.............. '21......................1 Jl 18 to 15 D 18
Smn Pelham Bay Tr Sta N Y; 1 O 18 SATC C U

Fisher, John E................. *CE* '18....................1 Ap 18 to 1 Jn 19
Corp 303d Engrs France

Fisher, Harold S................'20..........................O 18 to D 18
SATC C U

Fisher, Phillip B................'11..........................My 17 to — —
OTC Ft Niagara N Y; Au 17 Capt Cp Meade Md; Ja 18 Ft Sill Okla; Ap 18 Cp Meade Md; 10 Jl 18 AEF

Fishman, Benjamin N...........'20........................26 F 18 to 25 Mr19
Corp 302d Engrs; Mr 18 France; 31 Au 18 Casual; Wounded Vesle River

Fitch, Charles W..............*CE* '10....................22 Jl 17 to 14 Ap 19
Sgt 1st Cl 17th Engrs (Ry.); 1 Au 17 Mast Engr (SG); 1 O 17 Capt; 13 F 19 Major; 4 Mr 19 Lt-Col

Fitzgerald, James W............*CE* '18..................14 Ja 18 to 18 Ja 19
Pvt ERC C U Ithaca N Y; I Jn 18 Pvt Ord Sheffield Ala

Fitzgerald, John M.............*CE* '09.........................
EOTC Cp Humphreys Va

Fitzpatrick, Paul E.............'21........................Jl 18 to 18 Ja 19
USSMA MIT Boston Mass

Flanigan, Horace C.............*CE* '12....................14 D 17 to 7 Ja 19
Ensign USNRF

Fleck, Jesse W.................'20.............................
USSMA C U Ithaca N Y

Fleming, Thomas J.............*CE* '13.....................5 S 17 to 25 Jl 19
304th Inf; My 18 EOTC; Jl 18 2d Lt 543d Engrs

Flynn, Walter F J..............*CE* '12....................15 My 17 to 11 D 18
2d Lt ERC Plattsburg N Y; Cp Amer Univ Washington DC; O 17 Engr Depot In Chg of Desn & Drftg Div; Au 18 1st Lt Engrs; O 18 79th Engrs Cp Leach Washington D C

Folger, Bertand K..............'19........................Au 17 to — — —
AS; D 17 Sgt; O 18 OTC; F 19 2d Lt

Foote, Benjamin F..............*CE* '16................23 My 17 to 15 My 19
Sgt 29th Engrs Constr France

Forster, Murrill H..............'21..........................O 18 to D 18
SATC C U

Fortier, Ernest C...............*CE* '18..................12 Ja 18 to 4 F 19
ERC C U Ithaca N Y; 5 Jn 18 Act Ser; 10 Jn 18 Pvt 1st Cl EOTC Cp Lee Va; 19 Au 18 2d Lt Engrs; 6 S 18 6th Engr Tr Rgt Cp Humphreys Va; 1 O 18 218th Engrs

Foster, Henry A................*CE* '16.................20 S 17 to 11 Jl 19
Pvt 303d Engrs; 20 O 17 29th Engrs France; 10 D 17 Pvt 1st Cl; 5 Mr 19 Corp; 17 My 19 Sgt; 4 Jn 19 2d Lt

Foster, Willard S...............'17..........................Jl 17 to 13 D 18
Pvt 1st Cl AS USSMA Ithaca NY

Fountain, Thomas L............*CE* '05...................D 17 to — — —
Capt 17th Engrs (Ry) France

Fowler, Charles H..............*CE* '14...................12 My 17 to 18 D 18
Cand EOTS Madison Barracks NY & Washington Univ D C; Au 17 2d Lt 6th Engrs France; Au 18 1st Lt Instr Ft Benjamin Harrison Ind

Fowler, E Washburne...........'10.............................
1st Lt QMC AEF

Fox, Charles J.................*CE* '11...........................
1st Lt Ord

Fox, William A.................'17........................Jn 17 to — — —
1st Lt Inf 30th Div; Wounded France

Fox, William B.................'21.....................27 Au 18 to 15 D 18
C QM Nav A S Gr Sch Minneapolis Minn; 27 S 18 Algiers Nav Sta Algiers Pa

Frank, George S..............*CE* '11...................10 Jl 17 to 21 O 19
1st Lt AS; 2 O 18 Capt

Frank, Harry H ....*CE* '12...................19 Ap 18 to 27 Jn 19
Pvt Met Sec S C College Sta Tex

Freeman, George W............*CE* '81...................18 Ap 17 to ———
Major C O Engr Sec EOC; 23 Jl 17 Ft Leavenworth Kan; 5 S 17 109th Engrs Cp Cody N M; 19 N 17 Dist Engr St Paul Dist

Freeman, Louis S..............'22.........................O 18 to D 18
SATC C U

Freeman, William B...........*CE* '05.....................2 S 17 to 20 Jl 19
2d EOTC Ft Leavenworth Kan; 25 O 17 Capt 509th Engrs Cp Travis Tex; 19 F 18 France; 7 Ap 19 Major; 19 Ap 19 Citation by Gen Pershing for especially meritorious and distinguished service.

Fritz, William H Jr............*CE* '16..................1 My 17 to 18 D 18
1 Ja 18 1st Lt 103d FA; 18 S 18 Capt 39th FA France

Frost, Charles P..............*CE* '16..................11 My 17 to 30 Jn 19
Jn 17 Corp 15th Engrs Gievres France; 1 N 17 Det Ser Div Constr & For (Engrs) Paris & Tours France; 13 D 18 Mast Engr (JG) Engr Val Bd Tours France; 21 Mr 19 Amer Schl Det Univ de Besançon France

Frucht, Nathaniel ....'16..............................
1st Lt Engrs Tours France

Fuller, Avery E...............'18....................3 Ap 18 to 12 Jn 19
Cp Dix N J; 26 My 18 France

Fuller, Weston E..............*CE* '00.........................
Capt 34th Engrs

Fulton, William J.............*CE* '12..................27 Jn 17 to 15 My 19
Pvt 16th FA; 9 S 17 Corp; 7 D 17 Sgt; 9 Mr 18 2d Lt Engrs: 11 Mr 18 2d Lt T C 327th Btn

Gaffron, Carl W..............'21............................O 18 to D 18
SATC C U

Gardner, Kenneth H.............'18 ....
Engr Corps

Garrett, Robert P.............*CE* '97..................16 Jl 18 to 9 Jn 19
Capt Ord Ry & Seacoast Carriage Sec Engrs Div Washington DC

Garrett, Seymour S............*CE* '04................13 My 17 to 28 Mr 19
Au 17 Capt 303d Engrs; F 18 1st Engrs; Jl 18 Tank Schl; S 18 306th Bgde T C; O 18 Capt

Gastlick, Samuel L............*CE* '11.....................N 17 to Jl 19
1st Lt 509th Engrs

Gavett, Weston ....*CE* '11 *MCE* '12..........28 N 17 to 8 Jl 19
1s Lt San Corps Cp Hancock Ga; Au 18 In Chg Water Lab BS No 7 France Capt; N 18

Gebhart, John C..............*CE* '19.....................1 S 18 to 23 D 18
OTC Ft Monroe Va; 2d Lt Hvy Art USR In Active Duty

Gelman, Abraham ....'22..........................O 18 to D 18
SATC C U

George, Henry H 3d ....*CE* '12.......................
Capt 105th Engrs AEF

Gildea, Ray Y.................*CE* '12....................21 Mr 18 to 9 Jl 19
1st Lt; 3 Au 18 CO San Sqdn No 78 38th Div; 5 O 18 France

Gillett, Maurice E . . . . '20 . . . . 16 Ap 17 to D 18
Smn USNRF Newport R I; Jn 17 Destroyer Vesuvius; O 17 Inact Duty; Jn 18 Nantucket Mass

Gillette, Harold S . . . . *CE* '10 . . . . 21 Au 17 to 27 O 19
Genl Staff Washington DC; 27 S 19 Dept Engrs Off San Antonio Tex

Girard, Peter F Jr . . . . '22 . . . . 8 Au 18 to 6 F 19
Corp 36th H FA 12th Div Cp McClellan Ala

Glenzing, William L . . . . '18 . . . . S 17 to 11 Ja 19
Pvt 302d Engrs Cp Upton N Y; Corp; Sgt; Ja 18 OTC Cp Lee Va; Ap 18 2d Lt Engrs; Au 18 Constr Dept Cp Hdq

Glose, Robert L . . . . *CE* '15 . . . . 11 My 17 to 3 Mr 19
Stu Off 1st OTC Ft Niagara N Y; Au 17 2d Lt 304th Engrs 79th Div; F 18 1st Lt AGD 79th Div Hdq Cp Meade Md & France; S 18 Capt AGD Asst Chf of Staff G-1 79th Div Hdq; Meuse-Argonne Offensive

Gonzalez, Rafael . . . . *CE* '11 . . . . 20 Jl 18 to Ap 19
Pvt 1st Cl 3d PR OTC; 5 N 18 1st Lt 374th Inf; Ap 19 In Active Duty

Goodman, Benjamin . . . . *CE* '14 . . . . 11 D 17 to 28 N 19
Pvt 447th Dep Det Engrs; Sgt 1st Cl 504th Engrs; 2d Lt 1st Lt 2d Corps 315th Engrs; Instr Ecole Polytechnique 1st Engrs

Goodwin, Harry L . . . . *CE* '15 . . . . 24 Ja 18 to 23 Jn 19
20 O 18 Ensign Nav AS

Gordon, George . . . . *CE* '17 . . . . 27 F 18 to 27 Jl 19
Pvt Hdq 302d Engrs

Gouinlock, Harold . . . . *CE* '12 . . . . 14 My 17 to 19 Jn 19
Cand Madison Barracks N Y; 15 Au 17 1st Lt 303d Engrs Cp Dix N J & France; Ap 19 Capt

Graham, Roland R . . . . *CE* '12 . . . . 22 Au 17 to 22 N 17
Stu 2d OTC Ft Niagara NY

Graham, Samuel A . . . . *CE* '11 . . . . 23 Jn 17 to 3 F 19
4 S 17 1st Lt 25th Engrs; 30 O 17 France; 1 N 18 B Hospital No 6; 15 D 18 Engrs BS No 2

Graham, William S . . . . *CE* '16 . . . . 15 D 17 to 26 Mr 19
30 Ja 18 Pvt 29th Engrs France; 4 D 18 74th Engrs

Grantz, Walter A H . . . . '20 . . . . 7 Ja 18 to 11 D 18
Pvt CAC Ft Slocum NY; 26 Jn 18 CAC Det Ft San Cristobel PR; 6 Ap 18 4th CACOTC Ft Monroe Va; 26 Jn 18 2d Lt CARC Ft Winfield Scott Calif; N 18 26th CA Ft Screven Ga

Gray, Joseph H . . . . *CE* '17 . . . . My 17 to N 18
Amer Amb Ser with French Army; O 17 Ensign Nav AS France

Gray, Ralph . . . . '21 . . . . O 18 to D 18
Smn 1st Cl Pelham Bay Tr Sta NY

Green, Archibald W . . . . *Sp* '17 . . . . 11 My 17 to 7 Ap 19
OTC Madison Barracks NY; 29 Au 17 2d Lt 307th FA Cp Dix NJ; 31 D 17 1st Lt; 1 My 18 France; St Mihiel Swaepe Moselle Argonne-Meuse Offensives

Green, Charles N . . . . *CE* '88 . . . . 28 D 17 to 11 O 19
Major Engrs; 25 F 18 Constr QM

Green, Joseph L . . . . *CE* '12 . . . . 26 Jl 17 to 19 D 18
Pvt Ord Dept San Antonio Arsenal Tex; 1 N 17 Ord Sgt in Chg Ord Sch Univ of Calif; 2d Lt CO; 10 My 18 Instr in Ammunition at OTS Aberdeen Prvg Grds Aberdeen Md

Green, Samuel C . . . . '13 . . . . O 18 to D 18
SATC CU

Green, Severn T W . . . '18 . . . 11 Ap 17 to — — —
Engrs France; 11 Jn 17 2d Lt 2d Corps Schl France

Griffin, Harold W . . . '23 . . . O 18 to D 18
SATC CU

Griffin, Lawrence . . . *CE* '10 . . . 5 O 17 to 13 Mr 19
Sgt 29th Engrs France

Gromfine, John J . . . *CE* '17 . . . 17 Au 17 to 24 N 19
1st Lt Engrs Rpl Rgts Washington Barracks DC Cp Lee Va Cp Humphreys Va & Cp Merritt NJ; Ja 19 3d Engrs Panama C Z

Gross, Max . . . *CE* '17 . . . 25 My 18 to 2 Ja 19
Pvt MG T Co Cp Hancock Ga; Cp Psychologist Off; Corp Div Hdq Perm Personnel MGT Co

Guilbert, Richard T . . . *CE* '17 . . . 4 Ap 17 to 30 My 19
B M 1st Cl USN Recr & Instrn Bensonhurst NY; 19 S 17 Ensign USNRF Stu Columbia Univ NYC; 10 O 17 Stu US Nav Acad Annapolis Md; 4 F 18 Ensign USN Stu Sub Sch New London Conn; 11 Jl 18 Lt (JG) USS G-I New London Conn; 7 S 18 USS D-2 Philadelphia Pa; 10 F 19 USS L-A Philadelphia Pa & Norfolk Va CO part of time

Gumboldt, Frank W . . . '21 . . . 2 Ja 18 to 31 D 18
Plattsburg N Y; 15 S 17 2d Lt Inf College Park Md

Hacker, Theodore W . . . *CE* '17 . . . 1 Ap 18 to 8 Mr 19
Ensign USNRF; Pub Wks Dept Nav Base Norfolk Va

Haecker, Julius H . . . '18 . . . 30 O 16 to — — —
Sgt 3d FA

Hagedorn, Charles B . . . '86 . . . '88 to 8 O 18
West Point '89; '89 2d Lt 23d Inf; '96 1st Lt; '99 Capt 17th Inf; '11 Major Inf; Mil Attache Am Leg Petrograd Russia; Chf of Staff Panama CZ; 5 N 17 Col; 7 S 18 CO Cp Grant Ill; 8 O 18 Died

Hagg rt, William H R . . . *CE* '17 . . . 6 D 17 to 17 F 19
Au 18 Ch MM USN AS France

Hales, Felix S . . . *CE* '16 . . . 28 Jn 18 to 10 D 18
Pvt 4th Tr Btn Cp Sherman O; 309th Engrs; 23 Jl 18 Cand FACOTS Cp Taylor Ky; 31 O 18 2d Lt FA; 6 N 18 Cp Jackson SC

Haley, Francis A . . . *CE* '19 . . . 2 F 18 to 13 D 18
Pvt Engr R; 1 O 18 SATC CU

Ham, D Harvey . . . *CE* '14 . . .
Pvt Sig R Balloon Sch Ft Omaha Nebr

Hamlin, Harold F . . . *CE* '05 . . . Au 18 to D 18
Capt 2d Engr Tr Rgt Cp Humphreys Va

Hammond, Theodore E . . . *Sp* '13 . . .
Ensign USNFR; Trial Capt of new Submarines Bridgeport Conn

Hanf, Porter V . . . *CE* '15 . . . 5 S 17 to 9 D 18
Sgt 364th Inf Cp Lewis Wash; 16 My 18 2d Lt Engrs NA Cp Leach DC; 9 Jl 18 1st Lt Engrs Ft Benjamin Harrison Ind; 9 D 18 3d Engrs Schofield Bar HT

Hannan, David E . . . *CE* '07 . . . 6 My 17 to 18 D 18
Au 17 Capt 26th Engrs; N 17 24th Engrs; Ja 18 Capt TC Staff; S 18 CO 307th Heavy Btn; CO Cp Polk Raleigh NC; Planned & organized Am Tank Sch Cp Tobyhanna Pa & Raleigh NC

Hannigan, James . . . '22 . . . 18 to 19
Pvt 116th Engrs 41st Div France; 509th Engrs SOS; Stu Det Univ of London England

Hardin, George D. . . . . *CE* '13. 14 My 17 to 19 Jl 19
EOTC; 23 Jn 17 1st Lt Engrs; 17 Au 17 308th Engrs; 31 O 17 106th Engrs; 28 My 19 Capt

Harrington, Arthur W. . . . . *CE* '09. 6 N 18 to date
1st Lt San Corps USA; Cp Greenleaf Ga; 10 D 18 Cp San Engr Eberts Field Ark; 1 Mr 19 Cp San Engr Barron Fld Tex; 11 Ap 19 Cp San Engr Ellington Fld Tex; Asst Constrg QM Cp Bragg N C

Harrington, Harold R . . . . '21. . . . . O 18 to D 18
SATC CU

Harrington, R J . . . . '23. . . . . O 18 to D 18
SATC CU

Harris, Frederick M. . . . . '18. . . . . 8 My 17 to 13 F 19
US Nav Landsman for Av; 2 Ja 18 Ensign Nav Av Instr Miami Fla; 4 Jl 18 Pensacola Nav Air Sta Fla; 4 S 18 Northern Bombing Group France

Harris, Thomas W. . . . . '17. . . . . 17 Jl 17 to 11 Jn 19
Amb Ser

Harrison, Bernard J. . . . . '20. . . . . O 18 to D 18
SATC CU

Hart, Austin S. . . . . '14 . . . .
1st Lt 17th Engrs (Ry) France

Hart, Roy J. . . . . *Sp* '17. 7 N 17 to 21 Jl 19
Pvt 23d Engrs Cp Meade Md; 6 F 18 Pvt 1st Cl France; 3 Mr 19 Stu Sorbonne Univ Paris; Aisne-Marne Oise-Aisne & Meuse-Argonne Offensive

Hartman, Eugene L. . . . . *CE* '11. 15 Jl 17 to 29 N 18
2d Lt 103d Engrs France; 22 S 17 1st Lt; 30 Jl 18 Capt Cp Humphreys Va; 12 Au 18 Casual

Hartmayer, Herbert W K. . . . . '20. . . . . O 18 to D 18
SATC CU

Hartz, Roger S B. . . . . *CE* '13. . . . . 13 to 20
14 2d Lt 15th Cav Alpine Tex; 16 8th Cav Ft Bliss Tex; 17 1st Lt Cav Ft Hancock NJ; 18 Major 78th FA France; Lt Col Motor Tr Cp Holabird Md

Harwood, Warner. . . . . *CE* '16. . . . . My 17 to Jn 19
1st EOTC; S 17 2d Lt 309th Engrs Louisville Ky; Ap 19 1st Lt; Au 18 France

Hasbrouck, Carl J. . . . . '20. . . . . 4 Ja 18 to 30 N 18
Pvt AS USASMA CU Ithaca NY Cp Dick & Taylor Fld Tex

Haswell, John R. . . . . *CE* '09. . . . . 2 S 17 to 18 Mr 19
EORTC; D 17 Capt 23d Engrs; Ja 18 116th Engrs; Mr 18 128th Inf French; Ap 18 1st Engrs Montdidier Noyon Defensive; Jl 18 317th Engrs Argonne On board Tuscania when torpedoed

Hauck, Thomas S. . . . . *CE* '10. 12 My 17 to 10 Jl 19
EOTC Plattsburg NY & Cp Amer Univ DC; 15 Au 17 1st Lt Engrs Instr Cp Amer Univ DC; 1 D 17 305th Engrs Cp Lee Va; 1 My 18 603d Engrs Ft Benjamin Harrison Ind; 13 S 18 France; 29 O 18 Pontoons & Bridges Meuse-Argonne; 11 N 18 CO Co C Verdun Leffords Toulain Rd Constr

Hauser, James N. . . . . '11 . . . .
Lt

Hawley, John B Jr. . . . . '21. . . . . 2 O 18 to 2 N 18
SATC Univ of Tex Av Grd Sch

Hayden, John E . . . . *CE* '12. . . . . 12 My 17 to 24 Jl 19
2d Lt OTC Ft Leavenworth Kan; Au 17 1st Lt 311th Engrs Cp Grant Ill; Au 18 Capt France in Charge of Dist 4 Base Sec 2 Road Rep & Constr

Hayes, George DeN. . . . . '20. . . . . O 18 to D 18
SATC CU

Hayes, Jeremiah J .... *CE* '16 ....
1st Lt 49th Inf

Hearn, John B............... '23............... O 18 to D 18
SATC CU

Healy, Gerald F............... *CE* '15............... 15 My 17 to 2 Jl 19
15 Au 17 2d Lt 303d Engrs Cp Dix NJ; 31 O 18 1st Lt France

Heidt, Charles .... *CE* '15............... 2 N 18 to 17 Ja 19
Flying Cadet USSMA Princeton NJ; Av Conc Cp Dallas Tex; Rockwell Fld Calif; March Fld Calif; 9 O 18 2d Lt RMA AS; Pursuit Sch San Diego Calif

Heilich, Arthur C............... '19............... 11 Ap 18
OTC

Heinitsh, George M .... *CE* '15............... 3 N 17 to 25 Jl 19
Pvt Art; 8 D 17 Pvt 1st Cl SC; 16 F 18 USSMA Princeton NJ; Cp Dix Tex; Taliaferro Fld Tex; 17 Jn 18 2d Lt AS; 24 Jl 18 Pilot Sch of Aerial Observers Langley Fld Va; 1 N 18 3d AIC France; 5 F 19 88th Aero Sqdn; 14 Jn 19 51st San Sqdn

Hellquist, Oscar E............... '17............... 1 My 17 to 18 O 18
Pvt 7th Reg NYNG (107th US Inf); 5 Ja 18 OTC Cp Wadsworth SC; 2d Lt Inf Int Off 107th Inf; 17 O 18 Hit by shell Died following day; Cited by Maj-Gen O'Ryan

Hendricks, Ernest D............... *CE* '03............... 8 My 17 to 19 My 19
1st Lt (E) OTC Cp Dix NJ; Capt 303d Engrs France; Cited for distinguished and exceptional gallantry at Grand Pre France 30 O 18

Henry, Frederic T............... '23............... 10 D 17 to 15 Ap 19
Smn 1st Cl Torpedo Sta Newport RI; 2 S 18 USS Massachusetts; 25 My 18 USS Virginia; 15 Au 18 Philadelphia Navy Yard; 5 Ja 19 USS Munrie; 15 F 19 Philadelphia Navy Yard

Hequembourg, Charles G............... '97............... 10 Jl 17 to 24 Jn 19
5 Ja 18 1st Lt (E)ORC Cp Lee Va; 10 Ap 18 Engr Mat Div Prod; Br Gen Engr Depot Washington DC

Hequembourg, James T............... '16...............
AS Died of injury Airplane accident

Herd, Richard J .... '22............... O 18 to D 18
SATC CU

Herman, Abbott P............... *CE* '19............... O 18 to D 18
SATC C U

Herriman, Morris W............... '20............... 18
Naval Av ChQM

Herrman, David............... '17 ....
Pvt 1st Cl Hdqs Troop 4th Artillery; Sorbonne Detachment

Herrmann, Frank............... *CE* '14............... 25 Au 17 to 27 N 18
Cand ROTC Cp Stanley Tex; 10 Jn 18 Pvt Drill Instr Sch of Automobile Mech Cp Mabry Tex; 26 Au 18 Cand (E)OTC Cp Humphreys Va

Heslop, Paul L .... *CE* '14............... S 18 to F 19
Pvt Inf & Ord Depts; Army Ord Sch Pittsburgh Pa Tr for hyd expert in hyd tests of shells

Hess, Seth G............... *CE* '14............... 26 O 17 to 19
2d Lt & 1st Lt CAC Coast Defenses Sandy Hook N Y; 74th Art CAC (Ry) 15th Gr Div Trans Corps France

Hettinger, Harold I............... '20............... 1 O 18 to 8 D 18
Pvt COTS Cp Lee Va

Hettrick, Ernest F............... *CE* '10............... F 18 to D 18
Capt Constr Div

Heubeck, Elmer .... *CE* '12 .... 2 S 17 to 20 D 18
1st Lt (E)OTC; 1 D 17 Stu Att to 505th Serv Btn & 305th Engrs; 31 D 17 Instr (E)OTC; 17 Jn 18 Capt; 7 Au 18 Instr 1st Repl Rgt Engrs

Hill, Harry W .... *CE* '13 .... 14 My 17 —
19 Jn 17 1st Lt; 14 Au 17 Capt 307th Engrs; OTC; 144th Engrs; 211th Engrs; Genl Staff

Hill, Raymond C .... *CE* '12 .... 11 Ap 17 to 3 Ap 19
Corp 102d Engrs 27th Div France

Hillman, Charles A .... *CE* '17 .... 14 My 17 to 7 Ap 19
F 18 2d Lt AS; N 18 8th Aero Sqdn

Himes, Albert P .... *CE* '16 .... 28 Ap 18 to 17 My 19
Pvt 2nd San Squad 83d Div Cp Sherman O; 12 Jn 18 Le Mans France; 4 S 18 Sgt 469th Engrs Tr Cp Tours France

Hirsch, Emanuel .... '20 .... O 18 to D 18
SATC C U

Hiscock, George S .... *CE* '19 .... O 18 to D 18
SATC CU

Hock, Harold L .... *CE* '16 .... 16 Ap 17 to 30 Au 19
1st Lt Engrs; 14 My 17 EOTC 27 Au 17 303d Engrs Cp Dix NJ; 4 Ap 18 43d Engrs; 30 My 18 France; 11 Au 18 2d Engrs; Cited Div Ords 2d Div; Cited in French Orders; Awarded Croix de Guerre

Hofeller, Neville K .... '19 .... O 18 to D 18
SATC CU

Hofeller, Sigman K .... '19 .... 22 S 17 to 14 D 18
Av Sec SC Constr Div Carruthers Field Tex: 21 D 17 Sgt 1st Cl; N 18 Langley Field Va

Hoff, Edwin J .... '21 .... 30 My 17 to 25 Au 19
Gunners Mate NTS Newport R I; 15 My 18 Ensign

Hoff, Trygre W .... '21 .... 25 Ap 17 to 4 D 18
Smn USNRF NTS Newport R I; 1 Jl 18 USS Denver

Hoffman, Charles A .... *CE* '17 .... 26 Jl 17 to 21 Mr 19
Asst to Exec Off Insp Dept SC Washington DC; Ja 18 2d Lt AS; Mr 18 Asst Engr Off Gerstner Field La

Hoffman, Jacob .... '22 ....
305th Engrs

Hofstader, Meyer .... *CE* '13 .... 8 My 17 to 5 F 19
Au 17 1st Lt 304th Engrs; Jl 18 Capt 212th Engrs

Hoge, Philip B .... *CE* '08 .... 15 My 17 to 26 F 19
Jl 17 1st Lt ERC; Mr 18 Capt QMC Constr Div

Holland, Franklin E .... *CE* '12 ....
1st Lt 22d Engrs

Holloway, Henry F jr .... *CE* '15 .... 15 My 17 to 3 Jn 19
2d Lt 314th FA; 27 Au 17 1st Lt; Hdq 155th FA Bgde

Holmquist, Carl G .... *CE* '10 .... 23 Au 17 to 6 D 18
Mr 18 Capt CAC Instr Heavy Art Sch France; Jl 18 Instr CASch Ft Monroe Va

Hopkins, Frank S .... *CE* '11 .... 17 O 17 to 27 My 19
Pvt 23d Engrs; 1 F 18 Corp France; 25 Mr 18 Sgt; 26 Mr 18 1st Sgt; Jn 18 Rg Sgt Major Off of Ch Engr 1st Army; Citation from Com in Chf AEF

Hough, Floyd W .... *CE* '19 .... 4 O 18 to 15 Jl 19
Inf OTS Cp Lee Va; 15 Jl 19 2d Lt Inf ORC

Hough, Lawrence C .... *CE* '14 .... 23 Au 17 to 30 N 18
2d OTC; 2d Lt CAC 53d Art France; Jl 18 Instr CASch Ft Monroe Va

Howard, David A...... ....*CE* '11......................29 Jl 18 to
Pvt Det 301 Water Tank Tr Co Cp Holabird Md; (E)OTC Cp Humphreys Va

Howell, Charles J...............*CE* '19.........................S 18 to Ja 19
Pvt FA Cp Jackson SC

Howes, Wallace A.... ....'19.........................My 17 to My 19
OTC Plattsburg N Y; Au 17 2d Lt 302d FA Cp Devens Mass; My 18 Instr 4th OTC; Jl 18 Btn Comms Off Adj France

Howland, Charles A ....*CE* '12...................13 Jl 17 to 3 Ap 19
1st Sgt 102d Engrs 27th Div France; Color Sgt

Hoyt, Raymond H..............*CE* '15..................16 Jn 18 to 10 D 18
Cand CATC Ft Monroe Va; 2d Lt Instr CATC; 1 N 18 34th Art

Huestis, Robert A ....'16......................28 Jn 17 to 30 Jl 19
2 S 17 2d Lt ERC Tr Cp Vancouver Barracks Wash; Ja 18 318th Engrs; 27 Mr 18 Sp Duty Cp Humphreys Va; 8 Jn 18 MP; 8 Au 18 CO Prov Co 67th Engrs Cp G M Dodge Ia; St Nazaire France; 31 Ja 19 Cp Personnel Off; Asst Adj & Adj; 30 Jl 19 1st Lt

Hugger, Albert J...... ....'21.........................1 O 18 to 15 Ja 19
Pvt 1st Cl Cp Lee Va OTC; 2d Lt Inf

Hulburd, Lucius S...............*CE* '03.......................Au 18 to 1 D 18
Capt Engrs Cp Humphreys Va

Humphreys, Thomas O..........'11.........................7 Ap 09 to date
2d Lt CAC Ft Terry NY & Ft Monroe Va; 11 Mr 11 1st Lt; 1 Jl 16 Capt 7th Rgt Ft Adams RI & France; 25 Ap 18 Major Coast Defenses of Boston Mass; 18 S 18 Lt Col Mem Nat Ord Bd; Staff of CATCen Ft Monroe Va; 8 O 19 CO Ft Story Va

Hunkin, Alger E................'20......................1 S 18 to 16 Ja 19
Pvt CAC Ft Monroe Va; 16 Ja 19 2d Lt CAC Inactive Duty

Hunkin, Samuel E... ....*CE* '17..................21 Jl 17 to 7 Ap 19
Pvt & Master Engr (S G) 112th Engrs Montgomery Ala; 21 D 17 2d Lt France 12 Mr 18 1st Lt; 22 F 19 Capt Div Top Off & Asst G-2 37th Div; 18 N 18 Div Citation Meritorious Service Baccaratt See Meuse-Argonne St Mihiel Ypres-Lys Ypres-L'Escout

Hungerford, Stanley J.......... '20......................15 D 17 to 17 D 18
Landsman USN Sub-Chasers; 5 Ja 18 Nav Av; 1 My 18 Ore-Boat Ser Great Lakes; 1 S 18 Hdq 3rd Naval District; 1 N 18 Ensign USNRF

Hunt, Clinton S.... ....*CE* '13....................20 S 17 to 12 Jn 19
Pvt Corp Sgt 303d Engrs Cp Dix NJ & France; Master Engr J G & Master Engr S G Hdq Co 303d Engrs

Hurlbut, Hinman B............*CE* '01..................7 N 17 to 12 Au 19
Capt Ord; 13 N 17 Constr Sec Supply Div Ord; 15 S 18 Ch Civ Engr Unit Constr Sec

Hurley, John P.... ....*CE* '07....................15 Jl 17 to — — —
28 O 17 Capt 165th Inf France; 21 Mr 18 Gassed; 27–28 Jl 18 Severely Wounded; 21 O 18 Army of Occ; 14 F 19 Reg Adj; 24 My 19 42d US Inf Baccaratt See Champ Agne Def No of Chatieu Thierry: Cited "for gallantry in action and brilliant leadership"

Huyck, Ralph S...............'22...........................O 18 to D 18
SATC C U

Hyde, Richard L.... ....*CE* '17..........................
USR 20th Engrs AEF; 2d Lt 3d Det 2d Btn 17th Engrs (Ry); O 18 1st Lt; Univ of London Eng

Hynds, Harold D.... ....*CE* '12...................25 O 17 to 25 Ja 19
1st Lt SC Av Sec; S 18 Capt AS

Iglehart, Joseph A W............*CE* '14..29 Jn 16 to 1 N 16 & 1 My 17 to 14 D 18
Pvt Md FA Tobyhanna Pa; 1 My 17 2d Lt Asst Instr Ft McPherson Ga; 1 S 17 Capt 321st FA 82d Div Cp Gordon Ga; 15 Ap 18 France; 30 Jl 18 Major; 1 O 18 28th FA Cp Funston Kans

Infanger, Adolph O.............*CE* '18.......................O 18 to D 18
SATC C U

Ingalls, Owen L................*CE* '86........................Mr 18 to Ja 19
Major 139th Engrs Cp Shelby Miss

Ingalls, Robert D..............*CE* '17 ....16 O 17 to 1 Ap 19
2d Lt; F 18 1st Lt; My 18 Capt; 8 Ja 18 5th Engrs

Ingersoll, Henry ....'16.........................'17 to 15 S 18
Corp 107th Inf 27th Div; 15 S 18 Died of Cerebro Spinal Meningitis at Cas Clearing Sta No. 21 British EF; Buried at Warons British Mil Cem Aux le Chateau France

James, Robert L................*CE* '12..........................
1st Lt & Capt 17th Engrs (Ry) France

James, Wilbur O................'23...................15 My 17 to 5 S 19
USN Elect Tr Pratt Inst Brooklyn NY; 5 J 18 Electrician 2d Cl USS Henderson

Jaret, Milton..................*CE* '14........................Jl 18 to date
Cand 4th OTC Cp Meade Md

Jay, Harold ....'16 ....
Sgt QMC Cp Sherman O

Johnson, Berkely ....'20 ....
Ensign USN

Johnson, Charles R.............*CE* '13...................27 D 17 to — — —
Lt (JG) CE Corps USN; 8 Ja 18 Trng Annapolis Md; 12 F 18 Nav Base Hampton Rds Va; 1 Jl 18 Lt (SG); 4 N 19 Sub Base New London Conn

Johnson, Donald S..............*CE* '15.................15 My 17 to 7 My 19
1st OTC Ft Sheridan Ill; 2d Lt 342d Inf Cp Grant Ill; 8 Ap 18 Rahe Army Auto Sch Kansas City Mo; 20 S 18 CO SATC 1st Dist Normal Sch Kirksville Mo; 28 O 18 1st Lt Inf

Johnson, Harvey S..............*CE* '11.....................16 to 26 My 19
Corp Tex; 1st OTC Madison Barracks NY; 15 Au 17 2d Lt 309th FA Cp Dix NJ; 31 D 17 1st Lt France

Johnson, H G ....'85..............................
1st Lt MG

Johnson, Hollister ....*CE* '12...................26 Jl 17 to 25 S 19
2d Lt Engrs; 2 S 17 Amer Univ Washington DC; 27 S 17 20th Engrs; 26 N 17 France; 20 Jn 18 Hdq Dept Const & For; 7 Jl 18 Capt; 10 N 18 2d Corps Sch; 23 D 18 Top Off 115th Engrs; My 19 Hdq Army of Occ Germany; 11 Au 19 Asst to Dist Engr New Orleans La

Johnson, James A...............*CE* '13 ....
2d Lt 1st Engrs AEF; Capt Engrs

Johnston, Jesse C..............*CE* '13................15 My 18 to 10 D 18
Cand FACOTS; 10 D 18 2d Lt FA

Johnston, Miles C..............'12.....................23 Au 17 to 18 F 19
2d Lt Engrg Work AS France; Jl 18 1st Lt France

Jomo, Joseph G.................'21...........................O 18 to D 18
SATC C U

Jones, Bevan...................*CE* '06.................15 My 17 to 23 Ap 19
ROTC; 15 Au 17 1st Lt ERC; 27 Au 17 303d Engrs 78th Div Cp Dix NJ; 27 My 18 France; 7 Ja 18 Capt

Jones, Harold H . . . . *CE* '10. . . . . .9 Jn 16 to 31 Mr 19
Pvt 1st Cav Brownsville Tex; 4 Ja 17 2d Lt 3d NYFA Bgde Buffalo NY; Au 17 106th FA Spartanburg SC; 1 D 17 1st Lt 52d FA; Jn 18 France; 19 F 19 Capt

Jones, William M . . . . *CE* '18. . . . . .Jn 18 to Mr 19
2d Lt 116th Engrs

Joseph, Abram. . . . . '15. . . . .
Ensign USN

Joseph, Louis W . . . . '20. . . . . .5 S 18 to 15 Ja 19
2d Lt CAC Ft Monroe Va

Kaufman, Ernest G. . . . . *CE* '11. . . . .
2d Lt QMC Constr Div; Jl 18 Pvt 499th Aero Sqdn Langley Fld Va

Kaufman, Samuel . . . . *CE* '19. . . . . S 18 to 17 D 18
SATC CU

Keating, Thomas F . . . . *CE* '17. . . . . .24 Au 17 to 25 Ja 19
Cas 2d Lt 51st Art France; 1st Lt 57th Art

Keller, Arthur R. . . . . *CE* '03. . . . . .Jn 17 to 23 Jl 19
Capt EOTC Cp Lee Va & Cp Humphreys Va; 1 O 18 Off Chf of Engrs Mil Rys Sec

Kellogg, George D. . . . . *CE* '07. . . . . .13 Au 18 to 9 Ja 19
Capt 552d Engrs Ser Btn Cp Humphreys Va

Kelly, Edward J Jr . . . . *CE* '12. . . . .
2d Lt 852d Engrs Trans Corps

Kennedy, Robert C. . . . . '21. . . . . .O 18 to D 18
SATC CU

Kerby, Charles K. . . . . *CE* '15. . . . . .11 S 17 to 23 Jl 19
Sgt 503d Engrs Cp Merritt NJ Cp Grant Ill Ft Slocum NY; 11 D 17 St Nazaire France

Kerby, Russell T. . . . . *CE* '13. . . . . .Ap 17 to 15 Jl 19
6 My 17 2d Lt ROTC Ft Oglethorpe Ga; 30 S 17 Capt 318th MG Btn France

Kibbe, Harmon C. . . . . *CE* '16. . . . . .28 D 17 to 13 Jn 19
2d Lt EROTC Cp Lee Va; 9 Mr 18 307th Engrs Atlanta Ga; My 18 France; 28 O 18 1st Lt

Kidde, Reguar T. . . . . *CE* '13. . . . .— — — to 2 My 19
1st Lt 308th Inf Cp Upton NY; 15 Au 18 Gassed Vesle River

King, Clifford M . . . . *CE* '04. . . . . .25 S 17 to 14 Jl 19
O 17 EOTC Ft Leavenworth Kans; 10 D 17 Capt 313th Engrs Cp Dodge Ia; Ja 18 Instr 3d OTC; 26 Ap 18 528th Engrs; Jl 18 Div of Lt Rys Toul Sector France St Mihiel Off

King, Paul. *CE* '16. . . . . .My 17 to O 19
Cand ROTC Plattsburg NY & Washington DC; Au 17 1st Lt Engrs with Dir Gen of Mil Rys Washington DC; 32d Engrs Cp Grant Ill & France; O 18 Capt Engrs Hdq 1st Btn 32d Engrs; Adj to Sec Engrs BS No 2 France

Kingsland, Larwence D Jr. . . . . . . *CE* '17. . . . .
Capt Engrs Const Dept Amer Red Cross Paris France

Kipp, Frederick M Jr . . . . *CE* '14. .2 S 17 to 27 Jn 19
2d Lt EOTC Amer Univ Washington DC; 33d Engrs Cp Devens Mass; 1 D 17 302d Engrs Cp Upton NY; Ja 18 33d Engrs; 5 My 18 1st Lt France

Kirschner, Charles . . . . *CE* '14. . . . . .30 My 18 to 11 D 18
Pvt 472d Engrs Washington DC; 22 Au 18 Stu EOTC Cp Humphreys Va

Klaber, John J . . . . *CE* '06 . . . . 2 S 17 to 23 My 19
1st Lt Engrs Gen Engr Depot Washington DC; Off Dir Gen of Mil Rys 39th Engrs; Tr Corps & Inter-Allied Ry Comm

Kneeland, Herbert D . . . . *CE* '10 . . . . 24 Au 17 to 14 Jl 19
25 N 17 Capt & Per Adj 82d FA Rgt Hdq Ft Bliss Tex

Knowlton, George E . . . . *CE* '20 . . . .
1st OTC Ft Meyer Va Lt USA

Knox, Herbert B, Jr . . . . '18 . . . . 27 O 17 to 23 N 18
1st Lt CAC USA

Koehler, John H . . . . '21 . . . . O 18 to D 18
SATC C U

Kohler, Albert H . . . . '22 . . . . O 18 to D 18
SATC C U

Korff, Harry O . . . . *CE* '16 . . . .
CE Corps USN with aviation constr unit (French)

Kraft, George L . . . . *CE* '15 . . . . 30 N 16 to ? . . . .
16 Ja 19 2d Lt; 1st Lt; Capt 19th Inf 18th Div; Capt Gen Staff Purchase Storage & Traffic Div

Krauss, John S . . . . *CE* '17 . . . . 24 S 17 to 11 Jn 19
USN Steam Engrg Sch; 31 O 18 Chf Mach Mate; 20 Mr 18 Warrant Off; 20 My 18 Ensign

Kristal, Frank A . . . . *CE* '08 . . . . 6 Au 18 to 11 Mr 19
Ensign USNRF

Kurcias, Maxwell . . . . *CE* '18 . . . . 1 Jl 18 to 22 My 19
Warrant Off USNRF; 10 S 18 Ensign USS Winding Gulf Transport & Overseas Ser

Kurz, Ernest W . . . . *CE* '17 . . . . 2 My 18 to 11 Jn 19
2 My 18 Seaman 2d Class USNRF; Machinist USNRF Stu USN Steam Engrg Sch Stevens Inst Hoboken N J; Ap 19 Ensign; Overseas Ser USS Ice King

Laird, John E . . . . '18 . . . . Mr 18 to D 19
Ch QM USNAS; Ensign USNAS; Naval Avtr Bay Shore NY & Pensacola Fla

Lally, Clarence V . . . . '10 . . . . 17 My 17 to 26 D 18
18 Ja 18 Ensign USNRF Sub Base New London Conn; Lt (J G)

Lallou, George E S . . . . '20 . . . . S 18 to D 18
SATC CU 1st Sgt; OTC Cp Taylor Ky

Lamoureux, Vincent B . . . . '20 . . . . O 18 to D 18
SATC C U

Lane, Emory W . . . . *CE* '14 . . . . 1 Ap 18 to 21 D 18
Pvt Sgt (1st Cl); S 18 2d Lt AS (A); Constr Div Av Sec SC Rantoul Ill Lake Charles La; Supply Div Dowl Fld Fla & St Paul Minn

Launer, Clarence A . . . . '08 . . . . — — — to 24 Jn 19
Sgt Hdq Btn Army Service Corps Tours France

Laux, Herbert B . . . . '13 . . . . S 18 to 28 Mr 19
1st Lt Inf; 6 N 18 Capt Inf

Lawrence, Frank E . . . . *CE* '06 . . . . My 17 to 14 Jl 19
OTC Ft McPherson Ga Washington DC; Jl 17 1st Lt 17th Engrs (Ry); Base No 1; D 17 Capt; Ja 19 Major; Charge of food distribution under Mr Hoover in Adriatic District Ragosa Dalmatia

Laws, Owen . . . . '18 . . . .
Sgt San Corps Cp Meade Md

Lazo, Antonio .... *CE* '07.................... 17 Au 17 to 22 Ja 19

Capt Ord Dept; My 18 Gen Staff Finance Dept

Lee, Don...................... *CE* '13...................... Au 17 to F 19

2d OTC Leon Springs Tex; N 17 1st Lt 20th FA; Mr 18 Balloon Sch Ft Omaha Neb; My 18 20th FA AEF; S 18 Capt 65th FA Cp Kearney Calif; D 18 46th FA

Leffingwell, William M.......... '18...................... 1 My 17 to 2 My 19

Cand Off 1st OTC; 15 Au 17 2d Lt 50th Inf; 29 Mr 18 1st Lt

Leggett, Edward H............. *CE* '12...... Jl 16 to Mr 17 & My 17 to Au 19

Pvt 1st NY Cav McAllen Tex; My 17 OTC Madison Barracks NY; 15 Au 17 2d Lt 307th MG Btn 78th Div; 16 F 18 1st Lt; Jn 18 France; 20 Mr 19 Univ of Paris St Mihiel & Argonne

Lehman, Alvin S............... '21.......................... O 18 to D 18

SATC C U

Lehrbach, Henry G............. *CE* '15.................... 15 Jn 17 to date

Lt (JG) CEC USN Charleston Navy Yard; 16 O 17 Lt

Lehrbach, Warren W............ *CE* '17................... 26 S 17 to 15 Ap 19

Pvt Sgt 303d Engrs Cp Dix NJ; 20 My 18 Rgt Sgt Major

Leitch, Paul W .... '22.......................... O 18 to D 18

SATC Carnegie Institute Tech Pittsburgh Pa

Lenahan, Edwin J.............. '21.......................... O 18 to D 18

SATC C U

Leonard, Samuel J............. *CE* '17................. — — — to 17 D 18

1st Lt Engrs Cp Humphreys Va & Cp Baker Tex

Lester, George .... '22.......................... O 18 to D 18

SATC CU

Levine, Harold J.............. *CE* '12..........................

41st Rgt CAC

Levine, Lionel M.............. *CE* '12................... 11 O 17 to 4 Ap 19

Sgt 307th Engrs EROTC; Mr 18 1st Lt 26th Engrs (WS); Au 18 France

Levy, Robert .... *CE* '13................... 12 D 17 to 1 Jl 19

Ensign USNRF Bur of Steam Engrg; Radio Div Washington DC

Levy, Robert M................ '22..........................

SATC CU

Lewis, George P............... '18.................... 16 Jn 17 to 21 Mr 19

Pvt Air Service AEF

Lieblich, Israel L.............. '17...................... 18 S 18 to 12 D 18

O 18 Pvt Ord Engrs Washington DC; S 18 41st Co Depot Bgde Cp Meade Md

Ligon, Jaque M................ '22..........................

SATC C U

Lindau, Sigmund B .... *CE* '18.................... 3 S 18 to 28 Ja 19

Pvt 1st Cl QMC

Lindberg, Henry E............. *CE* '19....................... O 18 to D 18

SATC C U

Linnell, Herbert H.............. '20...................... 2 O 18 to 15 Ja 19

SATC C U; 11 O 18 IOTC Cp Lee Va; 15 Ja 19 2d Lt USR Inactive Duty

Linnell. Philip W .... '21...................... 2 O 18 to 15 Ja 19

SATC CU; 10 O 18 IOTC Cp Lee Va; 15 Ja 19 2d Lt USR Inactive Duty

Linsley, Charles W .... *CE* '07.................... 8 Ap 18 to 8 Ap 19

Lt (JG) CEC USNRF Asst Pub Wks Off Naval Optg Base Hampton Roads Va

Linton, Orlando H . . . . *CE* '06. . . . . Jn 15 to Jn 19
3d Can Siege Bat; Mr 17 Capt Hdq Staff Can Corps Hvy Art; Jn 19 Mentioned in Sir Douglas Haig's Despatches

Livermore, Norman B. . . . . *CE* '95. 2 S 17 to 13 Ja 19
Capt & Major Engrs Served with British Army & with MTC France

Lockerby, Robert A. . . . . *CE* '06. . . . .
1st Lt British Inf

Loeffler, Hermann C. . . . . *CE* '16. 28 Jl 17 to 25 Au 19
Pvt 30th & 10th Aero Sqdns France; 25 Au 18 Flying Sch at 3d AIC; 11 N 18 2d Lt AS Acrobacy Instr Tr Sch and with 41st Aero Sqdn; 3 Mr 19 Sorbonne Univ Paris

Loomis, Amos P. . . . . '22. . . . . O 18 to D 18
SATC C U

Loomis, Van Wyck W. . . . . *CE* '14. . . . . 31 Jl 17 to 31 Jl 19
Pvt 1st Cl; S 18 Wagoner Amb Co 33 4th Div

Lord, George W. . . . . *CE* '20. . . . . O 18 to D 18
SATC C U

Lordly, Henry R. . . . . *CE* '93. . . . . 20 Mr 16 to 1 Ap 19
Lt Col CO 5th Overseas Pioneer Btn; Jn 17 Special Work in Great Britain; Rec for recognition for engrg services; Awarded Officers Long Service Decoration

Lowes, James T . . . . '21. . . . . O 18 to D 18
SATC C U

Lowman, Shepard W. . . . . '22. . . . . O 18 to D 18
SATC C U

Lucas, Albert . . . . '20. . . . My 17 to Au 17 & 5 Ap 18 to 12 Jn 19
OTC Madison Barracks NY; Au 17 Disch Phys Dis; 5 Ap 18 Pvt 1st Cl 326th Inf 82d Div; 13 My 18 France; Toul St Mihiel Meuse-Argonne

Ludford, John E. . . . . '18. . . . .
Can Royal Flying Corps Cp Borden Toronto; 18 S 17 Killed in Aeroplane Accident

Lyerly, Charles A Jr . . . . *CE* '09. . . . . 17 My 17 to 7 Ja 19
Major 8th Engrs Mtd

Lyle, Alexander, Jr. . . . . *CE* '13. . . . . 25 Au 17 to 9 D 18
Cand 2d OTC Plattsburg NY & Ft Monroe Va; 27 N 17 1st Lt CARC Ft Hamilton NY; 11 S 18 Capt CARC; 17 O 18 Major CAC CO Ft Hamilton NY; 5 N 18 CAC Cp Eustis Va; Organized 32d CAC

Lynch, James H, Jr. . . . . *CE* '19. . . . . 25 Jn 18 to 13 D 18
SATC C U

Maas, Arthur J. . . . . '22. . . . . O 18 to D 18
SATC C U

Mabry, Amem E. . . . . '22. . . . . O 18 to D 18
SA TC C U

MacBean, John P. . . . . '20. . . . . 22 Jl 18 to 20 Jn 19
Appr Smn Great Lakes Tr Sta; 28 N 18 Pelham Bay NY; 9 D 18 QM; 14 D 18 USS Phoenix Le Havre Brest; 7 Mr 19 Pelham Bay NY; 27 My 19 Ensign USNRF

MacDairmid, Milo S . . . . *CE* '95. . . . .
23 Jn 17 Maj EORC Inactive Duty

MacGregor, Ross E . . . . *CE* '18. 31 Au 18 to 16 Ja 19
Pvt US Tr Det Durham NH; 26 O 18 Cand CA Sch Ft Monroe Va; 17 Ja 19 2d Lt CARC Inactive Duty

MacKellar, G. . . . . '20 . . . . O 18 to D 18
SATC C U

MacLeod, Norman . . . . *CE* '11 . . . . 9 Jn 18 to 15 Ap 19
2d Lt AS; O 18 1st Lt Bur of Aircraft Prod, Dist Mgr of Finance Pittsburg Pa

McCarthy, John R . . . . *CE* '17 . . . . 17 Ja 18 to 4 D 18
Pvt 1st Cl AS; 1 Jn 18 USSMA Princeton NJ; 10 S 18 Dallas Tex

McClatchey, John B . . . . '20 . . . . 11 N 18 to 28 N 18
Chf QM Naval Av Boston Mass

McCluer, John H, Jr . . . . '19 . . . . Jl 18 to S 19
Pvt Engr RC; 1 O 18 SATC C U; D 18 Engr RC

McClure, F L . . . . '21 . . . .
SATC C U

McClure, Hunter . . . . '10 . . . . D 17 to 26 S 18
1st Lt 21st Engrs; 26 S 18 Died of Spinal Menengitis, Buried in Amer Army Cemetery No 4 France

McClure, John H . . . . *CE* '19 . . . . O 18 to D 18
SATC C U

McClure, Ross G . . . . *CE* '16 . . . . 17 Au 17 to 10 Jl 19
OTC; 10 D 17 2d Lt 113th Engrs; 25 F 18 1st Lt 1st Engrs France; 25 D 18 314th Engrs Germany

McCrone, Rossiter . . . . '12 . . . .
1st Lt Engrs

McCullough, Frank W . . . . '21 . . . . 18 Jl 17 to 3 O 18
Pvt NG D C; 5Au 17 Ft Washington Md; 6 My 18 France; 3 O 18 Killed by Shell

McDermott, Thomas C . . . . '20 . . . . 5 S 17 to 7 F 19
Pvt 301st FA; 1 N17 Sgt; 1 Ja 18 Sgt 3d OTC Cp Devens Mass; 5 Ap 18 France; 15 My 81 Sgt Art Sch Saumer France; 12 Jl 18 2d Lt 78th FA 6th Div; 5 D 18 346th FA

McDonald, Jesse . . . . '16 . . . . 8 My 17 to ———
OTC Plattsburg NY; 2d Lt Inf 77th Div France; 2nd Div Germany

McDowell, Edwin T . . . . *CE* '14 . . . . 15 Jn 18 to 30 D 18
2d Lt CO Co 7th Tr Rgt (Engrs) Cp Humphreys Va

McGowan, Henri C . . . . *CE* '17 . . . . 11 My 17 to 18 Au 19
1st Lt; 1 O 17 Cas Off France; 1 D 17 With British Forces; 1 Ja 18 1st Lt & Capt CWS 2d Corps Sch & HDQ Army of Occ Germany

McGrath, F I . . . . '20 . . . . O 18 to D 18
SATC C U

McIver, Robert D . . . . '13 . . . .
2d Lt 33d Engrs Cp Devens Mass

McKee, Edward P . . . . '22 . . . . 6 Ap 17 to 19 Jl 18
Smn 2d Cl; 20 Au 17 Fed Rendezvous, Brooklyn NY; 20 S 17 Pelham Bay Tr Sta NY; 20 N 17 Naval Ord; Jn 18 Fed Rendezvous QM Detail; Jl 18 Naval Air Sta Montauk NY

McKenny, Philip E . . . . '22 . . . . O 18 to D 18
SATC C U

McKinistry, Ross W . . . . *CE* '18 . . . . 30 Ap 18 to 22 N 18
Pvt CAC; Master Gunner CAC Cas Det Ft Monroe Va & Chiefs Off Washington DC

McLoughlin, V . . . . '20 . . . . O 18 to D 18
Pvt MTC Cp Holabird Md

McMath, Neil C . . . . *CE* '14 . . . . 31 O 17 to 30 Jn 19
OTC; Ja 18 2d Lt 6th ACCB France; My 18 Aero Sqdn; S 18 185th Aero Sqdn 1st Pursuit Group

McMillan, A C . . . . '00 . . . .
Killed in Action

McMillan, Edwin R . . . . '17 . . . . 4 Ja 18 to 29 N 18
Cadet AS

McNair, George H S . . . . *CE* '18 . . . . 29 My 18 to 6 Ja 19
4th EOTC Cp Lee Va; 22 Au 18 2d Lt 210th Engrs AEF

McReynolds, Rex . . . . '21 . . . . O 18 to D 18
SATC C U; N 18 CA OTC Cp Taylor Ky

Mack, Francis A J . . . . *CE* '12 . . . . 15 My 18 to 13 D 18
FACOTS Cp Meade Md & Cp Taylor Ky; 31 Au 18 2d Lt FA at Cp Jackson SC & Ft Sill Okla

Mackenzie, Donald A . . . . *CE* '17 . . . . 16 My 17 to 28 Ja 19
Sub Net Constr New London Conn; Ja 18 QM USS Aroostook Mine Laying Sqdn No. 1 North Sea

Madden, William F . . . . '21 . . . . O 18 to D 18
SATC C U

Maher, Paul L . . . . *CE* '13 . . . . 6 N 18 to 31 Ja 19
Cand FACOTS Cp Taylor Ky; 31 Ja 19 2d Lt Inactive Duty

Mahoney, Lee C . . . . *CE* '12 . . . . S 17 to 28 O 19
1st Lt ERC Tr Cp Ft Leavenworth Kansas; D 17 23d Engrs Cp Meade Md; Ja 18 463d Engrs Ft Meyer Va; 29 Mr 18 France; 7 O 18 Capt MTC; 1 S 19 Presidio Calif

Maier, Edward L . . . . '21 . . . . O 18 to 7 F 19
SATC C U; N 18 Pvt OTC Ft Monroe Va; 5 F 19 2d Lt Hvy Art

Malone, George E . . . . *CE* '03 . . . .
Master Engr 57th Engrs France

Malone, William L . . . . '18 . . . .
Wounded twice severely during the last days of the war

Manchester, Wilbur O . . . . '20 . . . . O 18 to D 18
SATC C U

Mann, Roberts J . . . . *CE* '13 *MCE* '14 . . . . 14 My 17 to 15 My 19
OTC; 19 Jn 17 2d Lt EORC; 27 Au 17 307th Engrs Train; 14 O 18 1st Lt; 26 D 18 CO

Manson, William R . . . . '13 . . . . '16 & 30 My 17 to 10 My 19
Corp Border Service; 2d Lt & 1st Lt 149th FA 42d Div France

Marks, Alfred L . . . . *CE* '15 . . . . 27 Au 17 to 15 Ja 19
2d OTC Schofield Barracks Hawaii TH; 27 N 17 2d Lt 32d Inf; 23 Au 18 1st Lt 48th MG Btn Cp Kearney Calif

Marrian, Ralph R . . . . *CE* '15 . . . . '16 & '17 to 17 O 18
7th Rgt NGNY Border Serv; Ap 17 2d Lt Amer Univ Washington DC; N 17 105th Engrs 30th Div; 17 O 18 Struck by shell fragment while repairing roads under heavy fire and died in a dressing station at Bohain 30 minutes later

Marston, Anson . . . . *CE* '89 . . . . 25 Jl 17 to 14 D 19
Major CO 1st Btn Iowa Engrs; 1 O 17 CO 109th Engrs Cp Cody NM; 6 S 18 Lt Col CC 97th Engrs Cp Leach DC; Sch of Fire Cp Perry Ohio & special work in off of Chf of Engrs Washington DC

Martin, Charles E . . . . '21 . . . . O 18 to D 18
SATC C U

Maxeiner, Carl A . . . . *CE* '18. 30 Ap 18 to 15 Jn 19
Sgt 303d Engrs 78th Div; Citations S 18 in St Mihiel Offensive O & N 18 Argonne-Meuse Offensive

Mead, Robert G. . . . . *CE* '17. . . . . 13 My 17 to 28 My 19
1st Lt Cav; 19 Au 17 SD Sch of Trench Warfare; 2 O 17 1st Lt MG Co 311th Inf; 14 D 17 FA 303d Am Tr; 30 O 18 Capt

Meikle, A Craig. . . . . *CE* '15. . . . . 8 My 17 to 25 Jn 19
Pvt 1st ROTS Ft Meyer Va; 3 S 17 2d Lt 304th Engrs; 1 Jn 18 1st Lt

Mellen, Arthur W Jr. . . . . *CE* '17. . . . . Jl 17 to 1 F 19
Ensign USNRF Flying Corps

Menefee, Ferdinand N. . . . . *CE* '10. 2 S 17 to 29 My 19
8 O 17 Capt Ord RC; 25 Jl 18 Major

Mengers, Charles A. . . . . *CE* '15. . . . . 19 Mr 18 to 5 F 19
CMM USNRF Ord Philadelphia Pa; S 18 Ensign U S Naval Academy Annapolis Md

Mentzinger, W F Jr. . . . . '20. . . . . 7 Ap 17 to 24 F 19
Smn 1st Cl Newport Tr Sta; 1 Jl 17 New London Net Work; 15 S 17 Newport Mine Force; 7 Ja 18 New York Mine Force; 1 My 18 Mine Laying Sqdn North Sea; 1 Ja 19 Philadelphia Navy Yard

Mershon, Edward J. . . . . *CE* '14. . . . . F 17 to 7 Ja 19
US Naval Flying Corps Boston Mass Key West Fla Pensacola Fla; S 18 Ensign USNFC; Instr H-16 Curtiss Flying Boats Pensacola Fla

Meston, Robert S. . . . . *CE* '16. . . . . 13 My 17 to 16 My 19
2d Lt 1st Lt 12th Engrs (Ry) France; 12 Jn 18 Capt; Albert & St Quentin Cambrai St Mihiel Argonne

Meyers, Clarence W . . . . *CE* '03. 28 D 17 to 7 D 18
5 Ja 18 Capt OTC; 1 Mr 18 Constr Div; 20 S 18 79th Engrs

Michelson, Benjamin C. . . . . *CE* '19. . . . . O 18 to D 18
SATC C U

Mifflin, William B. . . . . '20. . . . . 8 S 17 to Au 19
Pvt 310th Inf 78th Div Cp Dix NJ; 8 O 17 Corp; Mr 18 Tr to Btn Int Sec; 19 My 18 France; 4 S 18 Sgt; F 19 Genl Hdq Det; St Mihiel Limey-Thiacourt Wounded several times

Milhan, David N . . . . *CE* '15. . . . . 11 My 17 to 1 Au 19
Cadet EOTC Cp Amer Univ DC; Au 17 1st Lt 106th Engrs Cp Wheeler Ga; Instr; S 18 France Constr

Miller, Granbery. . . . . *CE* '13. . . . . 28 Mr 18 to 12 My 19
Sgt MG Co 332d Rgt

Miller, Harold G . . . . *CE* '17. . . . . 25 Ja 18 to 8 Ap 19
2d Lt AS Insptr of Airplanes and Engines

Miller, John H . . . . *CE* '12. . . . . 8 Jn 18 to 21 Ja 19
Sgt 113th Engrs Sqdn AS (BAP)

Milliman, Ross. . . . . '19. . . . . Ap 17 to Mr 19
Cand OTC Madison Barracks NY; Au 17 2d Lt 309th HFA Cp Dix NJ; D 17 1st Lt; Jn 18 54th HFA Cp Travis Tex

Milmoe, James DeL. . . . . '22. . . . . O 18 to D 18
SATC C U

Mirick, Alfred S. . . . . *CE* '10. . . . .
1st Lt EORC

Miscall, Leonard .... *CE* '19.................... 22 Jn 18 to 14 D 18
Pvt Engrs RC; O 18 SATC C U Ithaca N Y

Mitchell, C Malcom .... '21 .... 5 Ap 17 to 7 F 19
USNRF Newport R I 28 D 17 Ensign Atlantic Fleet

Modjeski, Charles E J........... '20.......................... Jn 17 to D 18
Cornell Amb Un France; Ap 18 2d Lt Cp Jackson SC

Monaghan, Thomas A........... *CE* '17......................... —— to Jn19
US Navy

Monk, Percy S .... *CE* '10................ 27 Ap 19 to 20 Mr 19
1st Lt Engrs Cp Lee Va; 15 Jn 18 604th Engrs Washington Barracks DC; 15 Au 18 AEF; 3 S 18 29th Engrs

Moore, Archibald K P .... *CE* '17.................. 14 D 17 to 28 Au 19
Insp NA Brooklyn Aero Dist; 15 S 18 Ensign N A New York City

Moore, Charles B .... *CE* '16................. 25 S 17 to 1 O 19
2d Lt Engrs EOTC Ft Leavenworth Kan; 1 D 17 Mil Mapping S C & Ga; 1 F 18 Asst to Dept Engr Charleston S C; 15 Jn 19 Ch of Party Fla & Ala

Moore, Frederick P .... '08.......................... Jn 17 to 16 Jl 18
ROTC Ft Oglethorpe Ga; 26 N 17 Capt 30th Inf; 16 Jl 18 Killed in Action; Awarded posthumously DSC for extraordinary heroism in action

Moore, Howard R .... *CE* '13...................... 17 to 6 O 18
USSC Constr Av Flds Ft Worth Tex and Lonoke Ark; EOTC Cp Humphreys Va; 6 O 18 Died of Pneumonia

More, Charles C .... *MCE* '99................. 19 Jn 17 to 1 O 19
Capt ERC; 18 O 17 Capt Ord RC; 25 Jl 18 Major Ord; 4 S 17 EOTC Vancouver Barracks Wash; 10 N 17 Ord Dept Supply Div Constr Sec Washington DC; 3 D 18 Instr Engr School Cp Humphreys Va

Morton, John W .... *CE* '19.................. 12 D 17 to 6 F 19
4 Mr 18 USSMA MIT Boston Mass; 12 My 18 Flight Trng Bay Shore N Y Pensacola Fla; 27 Au 18 Ensign USNRF Pilot Montauk Pt N Y Hampton Rds Va

Mossman, Harold A .... *CE* '14...................... Jn 16 to 25 Ap 18
Can OTC; Au 16 England; 8 S 16 Pvt 28th Br Hussars "Artists Rifles"; St Johns Coll Oxford 23 Ja 17 2d Lt 6th Royal Berkshire Rgt; Mr 17 France; May 17 Wounded and sent to England; Jl 17 France; 6 F 18 Capt 3 Royal Berkshire Reg France; 25 Apr 18 Killed in action at Villers Bretonnex; Awarded Military Cross for bravery and devotion to duty at Poelcapelle on O 17 Awarded Parchment certificate for gallantry and devotion to duty in the Great Offensive of Spring of 1918

Muench, William O .... *CE* '12.................. 17 Jl 18 to 21 D 18
1st Lt Engrs USA Cp Lee Va; 10 Au 18 EOTS Cp Humphreys Va; 4 O 18 7th ET Rgt; 14 O 18 606th Engrs

Mulhern, Lawrence J .... *CE* '13........................
1st Lt Engrs AEF

Mullen, Frederick B .... *CE* '17..................... 8 N 17 to 23 Jl 19
Pvt 23d Engrs Ft Slocum N Y ; Cp Meade Md; 28 Mr 18 Nevers France; 12 Jl 18 Chg of Constr MTC Park Dijons France; 25 N 18 Supt Rep La Rochelle; 1 F 19 Master Engr Jr Gr; 1 Mr 19 Sorbonne Univ Paris

Mulliken, Alfred .... *CE* '18................. 21 Mr 18 to 29 Au 19
1st Lt San C USA San Engr & Staff Off Kelly Fld; CO 82d San Squad 86th Div AEF

Munn, Harvey T . . . . *CE* '13 . . . . My 17 to Jn 18
1st EOTC Ft Leavenworth Kan; Au 17 1st Lt Engrs in Chg WS Sec Off Ch of Engrs Washington DC; F 18 26th Engrs Cp Dix N J

Nagle, James C . . . . *MCE* '93 . . . . 13 Jn 17
Major EORC Not called into active service

Nash, Jack T . . . . *CE* '16 . . . . Au 17 to 25 Jl 19
1 My 18 2d Lt 524th Engrs France; 111th Engrs

Needle, Joseph . . . . *CE* '20 . . . . O 18 to D 18
SATC C U

Nelson, John I . . . . *CE* '12 . . . . 2 S 17 to 20 Jn 19
1st Lt 115th Engrs and 24th Engrs; 1st Lt & Capt 24th Engrs 1st 2d & 3d Armies France

Nethercot, David G . . . . '20 . . . .
Ensign Pilot USNA MIT Boston Mass San Diego Calif & Pensacola Fla

Neu, Edward W . . . . '21 . . . . 11 Ja 17 to 1 Mr 19
Pvt USA Amb Ser Cornell Sect Allentown Pa; 1 Ja 18 Ch Mech USA; 1 Au 18 France & Italy

Neumaier, Martin . . . . *CE* '16 . . . . My 18 to Au 19
Pvt 1st Cl Cp Merritt NJ; Jl 18 Sgt 29th Div France Meuse-Argonne Off

Neville, Colon W J . . . . *MCE* '01 . . . . 6 Ap 17 to Jl 19
Lt Com CO of 3rd Section 8th Naval Dist Hdq at Galveston Texas

Newbold, Thomas T . . . . *CE* '14 19 Jn 16 to 20 Mr 17 & 30 Mr 17 to 28 Jl 19
Pvt US Cac Mexican Border; 30 Mr 17 Pvt 1st Cav; 15 Au 17 1st Lt 302d Engrs; Au 18 Capt 544th Engrs

Newkirk, Arthur D . . . . *CE* '15 . . . . 14 My 17 to 24 Mr 19
2d Lt 1st Lt & Capt Engrs US and France 15 Mos Overseas

Newman, Gwendall B . . . . '16 . . . .
Marine Flying Field Miami Fla

Newman, Thomas S . . . . *CE* '03 . . . . 8 My 17 to 21 Au 19
Capt Engrs Stu Plattsburg NY & Amer Univ Washington DC; Au 17 Asst Constr QM Cp Shelby Miss; Ja 18 Instr EROTC Cp Lee Va; My 18 44th Engrs Ft Benj Harrison Ind; Au 18 France

Nicholson, James S . . . . '21 . . . . O 18 to D 18
SATC C U

Nicholson, Raymond V . . . . '21 . . . .
Ft Niagara NY

Nickerson, George L . . . . *CE* '14 . . . . 15 My 17 to 15 Ja 19
OTC; 8 Au 17 2d Lt Engrs; S 17 Det Ser France; D 17 101st Engrs 26th Div; 21 Jl 18 1st Lt Engrs; 30 Jl 18 Capt Engrs; 10 S 18 4th Engr Tr Rgt USA

Nickerson Paul U . . . . '22 . . . . O 18 to D 18
SATC C U

Nolan, Thomas J . . . . '15 . . . . 20 Jl 17 to date
1st Lt USNG 107th FA SRCAS as Aerial Art Obs

November, Nathan . . . . *CE* '19 . . . . O 18 to D 18
SATC C U

Nussbaum, Walter E . . . . *CE* '15 . . . . 13 Au 18 to 27 N 18
Pvt 1st Repl Rgt Engrs Washington Barracks DC; 30 S 18 Cand Off EOTS Cp Humphreys Va

Ober, John L. . . . . *CE* '16 . . . . O 18 to D 18
Corp 6th Art Ft Screven Ga

O'Brien, Earl F .... '20 .... 22 F 18 to 29 Jl 19
Pvt Hdq 76th Div Int Sec Cp Devens Mass; 12 Jl 18 France

O'Britis, Edward W .... '23 .... O 18 to D 18
SATC CU

Odessey, Herman P .... '21 .... 3 Au 17 to 6 N 19
USN Hydrographer Deck Off; 20 Ja 18 USS Matchless; 11 Ap 18 Ensign; 10 Ap 19 USS Onward; 11 S 19 Lt J G

Oettinger, David .... *CE* '14 .... 17 to 7 O 18
Pvt EOTC; Jn 18 1st Lt Util Det Cp Meade Md; 7 O 18 Died of influenza

Ogden, Doward W .... '23 .... O 18 to D 18
SATC CU

Ogier, George R .... *CE* '08 .... 2 S 17 to Ap 20
Capt 318th Engrs

Oglesby, Hart D .... *CE* '12 .... 8 My 18 to — — —
2d Lt ERC on inactive duty

Olds, Norman E .... '02–'03 ....
Bar-sur-Aulic France

O'Leary, James H .... *CE* '19 .... 10 F 18 to 15 Ja 19
Pvt CAC; Ap 18 Cand 4th OTC (CAC); Jl 18 2d Lt; Romsey England

Olmstead, Charles H .... *CE* '16 .... 27 Au 17 to 23 D 18
2d Lt Engrs; 2d Lt Art AS

Onstott, Virgil S .... '21 .... 1 O 18 to 15 D 18
SATC CU

O'Rourke, Bernard J .... *CE* '10 .... 27 N 17 to 7 Ja 19
1st Lt AS CO 5th Constr Co (Bricklaying) England

O'Rourke, Charles E .... *CE* '17 .... 7 D 17 to 14 D 18
Sgt 814th Depot Aero Sqdn; Instr USSMA Ithaca NY; 2d Lt S C Av

Overton, Hugh W .... '22 .... O 18 to D 18
SATC CU

Owen, Elijah H .... *CE* '99 .... 23 Au 18 to 20 My 19
Capt EOTC Cp Humphreys Va; 18 D 18 143d Engrs Cp Shelby Miss; Ja 19 E Tr Rgt Cp Humphreys Va; Mr 19 5th Engrs

Owens, Horace S .... '20 .... 19 Ap 17 to 9 Jl 19
GM USN Sub Patrol Plymouth England

Page, Blinn S .... *CE* '14 .... 8 N 17 to Ap 19
1st Lt Insp Div Ord Dept Insp of Ord 27 Cos in New York State Hdq at Buffalo N Y

Pancoast, Russell T .... '22 .... O 18 to D 18
SATC CU

Parker, Gilbert E .... *CE* '16 .... 11 My 17 to date
Stu Off 1st ROTC Ft Snelling Minn; 15 Au 17 2d Lt Inf; 26 O 17 1st Lt 26th Inf; 21 My 19 Aide-de-Camp to Maj Gen H P McCain Cp Devens Mass

Parkhurst, Roger W .... *CE* '13 .... 2 S 17 to 30 N 19
1st Lt ERC; 2d Lt (Reg) Stu EOTC Ft Leavenworth Kan; F 18 2d Lt Capt (Reg) 313th Engrs Cp Dodge Ia; 9 S 18 Capt Engrs Off Ch Engr Hdq SOS Tours France; N 18 Opr Off & Rgtl Adj 7th Engrs A of O Luxembourg Paris France and Cp Gordon Ga; O 19 Engr School Cp Humphreys Va

Parmenter, Richard .... *CE* '17 .... 27 Au 17 to 11 F 19
A S 1st Lt Escadrille 463 AEF

Patrick, Arthur S .... *CE* '15 .... 1 O 17 to 3 Jn 19
Sgt 317th FA 81st Div; 2d Lt Hdq Co 122d F A 33d Div AEF

Patterson, Burke ....'22....................13 Ap 17 to 30 D 18
4 Au 17 USNRF USS Kanawha; 30 N 17 Nav Militia Armory Brooklyn NY
4 Au 17 Electrician USS Leviathan

Pennywitt, John E..............*CE* '15...................6 Ja 18 to 4 Au 19
Pvt FA Rpl Dep Saumur FA Sch France; 2d Lt 21st FA; Hdq 5th Brgd

Perkins, Frank K ....*CE* '12..........................
1st Lt 303d Engrs AEF

Perkins, Nelson S ....*CE* '15...................26 N 17 to 24 Jn 19
25 F 18 2d Lt 64th Inf; 15 Jl 18 21st MG Btn 7th Div

Perlman, David ....*CE* '19........................O 18 to D 18
SATC CU

Perry, Arthur F Jr ....*CE* '16................27 Au 17 to 9 Ap 19
2d Lt 64th Art Ft Dade Fla; Jl 18 France

Phelon, Thaddeus W ....'19.........................S 17 to 17 S 18
Amer Amb Un Allentown Pa; 26 D 17 France; Injured when ambulance was shelled at Verdun; Jn 18 Base Hosp; 15 Au 18 Hosp Ellis Island NY; 17 S 18 Died

Philipson, Robert A ....*CE* '19......................O 18 to D 18
SATC CU

Phillips, Cushing ....*CE* '17.................11 Ap 17 to 23 Jn 19
Smn 2d Cl US NRF Newport RI; 15 Ja 18 Ensign Nav Acad Annapolis Md; 29 My 18 US Sub Sch; 5 N 18 Lt (J. G); Ja 19 Lt US Sub R-6

Phillips, John M................*CE* '14..................28 D 17 to 14 My 19
1st Lt 105th Engrs 30th Div France

Phinney, Charles M Jr..........'14 ....
2d Lt CAC

Picker, David H ....*CE* '13.................25 Au 17 to 17 Jl 19
15 D 17 2d Lt 315th Inf 79th Div Cp Meade Md; Jn 18 1st Lt; Jl 18 808th Inf

Pierce, George C ....*CE* '09..................29 S 17 to 19 F 18
Exec Asst Purchase Sect Gun Div Ord Dept; Ja 18 Head of Gen Control Sec Procurement Div Ord Dept; My 18 CO 2d Det Kelley Fld AS Rpl; Assigned to Adv Ord Depot No 4 as Munitions Off

Pierce, Leslie E.................*CE* '16......................1 S 17 to date
Cadet A S; F 18 2d Lt 184th Aero Sqdn; My 18 Army Sch for Aerntl Engrs MIT Boston Mass; Jn 18 Engr Div AS in ch of Res Sec McCook Fld Dayton O; S 18 Asst on Desn of Airplanes; Ja 19 Off in chg Structures and Aerodynamics Br AS

Pierce, Paul L ....*CE* '06..................1 Jn 17 to 1 Mr 19
Major Ord Dept; 15 Ja 18 Lt Col Ord Dept; F 18 France; Certificate of Meritorious Service; Legion of Honor

Piersol, John A ....*CE* '17..................10 My 17 to 3 Jn 19
Stu FAROTC Cp Niagara NY; Au 17 2d Lt 310th FA Cp Meade Md; 30 Jn 18 Exec Off France

Place, Arthur H ....*CE* '94....................6 O 17 to 1 S 18
Capt Ord Dept Washington D C

Ploss, Paul.....................*CE* '11..................2 S 17 to 10 Ja 19
EOTC Amer Univ Washington DC; 1 N 17 2d Lt Engrs Gen Engr Depot Off Ch of Engrs Washington DC; 1st Lt Engrs

Pollack, Waldemar..............'21..........................O 18 to D 18
SATC CU

Poole, Ruble I ....*CE* '10..........................
1st Lt Engineers

Pope, Herbert B ....*CE* '14..................21 Au 17 to 28 F 19
2d Lt AS; 15 Jn 18 486th Aero Sqdn Morrison Va; 3 Mr 18 France

Pope, Robert W ....'22..............................O 18 to D 18
SATC CU

Porter, Harry F ....*CE* '05..................27 Jl 17 to date
Capt QMC Asst Cp QM Cp Custer Mich; 27 N 17 Asst to Ch of Constr Div Washington DC; 1 F 18 Util Off Constr QM Cp Police Off Cp Fire Marshall Cp Taylor Ky; 28 Mr 19 Major; Washington D C; Ft Monroe Va

Powell, Hugh A ....*CE* '12..................5 Ja 18 to 15 Ja 19
1st Lt Engrs with Ord Dept Insp of Constr Steam Plant and Power Line to Nitrate Plant No 2 Muscle Shoals Ala

Pratt, Joshua D ....*CE* '15..........................
ROTC Schofield Barracks HT

Pratt, Roy E...................'21..........................O 18 to D 18
SATC CU

Prentice, Thomas H ....*CE* '11................23 O 17 to 26 Jl 19
Pvt 25th Engrs Cp Devens Mass; 11 N 17 Sgt France; 1 Au 18 Cand ACS Engr Sect Langres France; 1 O 18 2d Lt Engrs France and England

Prettyman, J Edward...........*CE* '19..................13 Jn 17 to 1 My 19
2d Lt EOTC Amer Univ Washington DC; 10 D 17 32d Engrs 77th Div; 29 Mr 18 France; 10 Au 18 1st Lt

Price, James D ....*CE* '16..........................
Sect 508 Amer Amb Corps

Priester, Oscar F ....*CE* '17.......................Jl 18 to N 18
Cand OTS Cp Taylor Ky

Priester, Walter A ....*CE* '15.....................1 S 18 to 6 D 18
Pvt CAC Ft Howard Md; OTC Ft Monroe Va; 2d Lt CARC

Proctor, Ralph F ....*CE* '01..................14 Jn 17 to 17 Jl 19
Constr QM in ch of constr of Cp Meade Md; 15 D 17 in ch of Constr of Curtis Bay Ord Depot Curtis Bay Md; Au 18 Lt Col

Puffer, Lewis R ....*CE* '15........................18 to 1 D 18
USSMA MIT Boston Mass; USSMA CU Ithaca NY; Eberts Fld Lonoke Ark; Cp Dick Tex

Purcell, Stuart ....*CE* '01................12 My 17 to 18 F 19
Capt Engrs Staff Duties; S 17 305th Engrs; D 17 Staff Duties

Quinn, John J Jr ....*CE* '17..........................
USSMA Ithaca NY; 1st Lt AS; 18 Mos Overseas Ser; Awarded Distinguished Service Cross

Quinton, Alfred B Jr ....*CE* '12.......................25 N 12 to date
2d Lt ; 1 Jl 16 1st Lt; 17 My 17 Capt Ord Dept CAC; 12 Ja 18 Major; 21 Jl 18 Lt Col; Cited for Meritorious Service in France

Quisumbing, Emilio ....*CE* '08..................23 Jn 17 to 23 D 18
Capt and Rgtl Adj Phillipine Guards; 11 O 18 Major Engrs

Radford, Charles F ....*CE* '15......................8 D 17 to 9 Jl 19
20th Engrs; 41st Engrs; Hdq Engr Det BS No 3 SOS London England; Master Engr (JG)

Raducziner, Joseph	'21	O 18 to D 18	SATC CU
Rafferty, Wiliam J F	'22	O 18 to D 18	SATC CU
Ragland, Edmund U	*CE* '14	25 Au 17 to 19 Au 19	27 N 17 1st Lt CAC; 6 Jl 18 Capt; 10 O 18 Major CAC US Mine Planter "Schofield"
Ramsey, James H	*CE* '13	2 Ja 16 to 19 My 19	25 O 16 5th Fld Co Can Engrs; My 18 Capt; Awarded Military Cross and Bar
Randolph, Alfred M	*CE* '14	15 Au 17 to 27 My 19	3 S 17 2d Lt 304th Engrs France; 24 D 17 1st Lt
Rapp, George W Jr	*CE* '16	27 Au 17 to 14 Mr 19	15 D 17 1st Lt 325th FA 84th Div; 1 Jn 18 350th FA; 29 Jn 18 France
Rappleye, Howard S	'15	24 S 17 to 23 D 18	2d Lt EORC; 11 Ja 18 disch for phys dis; 25 My 18 1st Lt and Btn Adj 9th Btn US Guard; 22 Au 18 Capt 32d Btn US Guard
Rasch, Charles J	*CE* '10		2d OTC Ft Meyer Va
Raynor, LeRoy P	*CE* '17	24 S 17 to 21 D 18	Lt (JG) USNRF; 3 Ja 18 Lt (SG) exec off US Mine Carrier "Lake Worth" North Atlantic Coast
Reck, William M	*CE* '14	3 Ja 18 to 17 F 19	2d Lt AS 478th Aero Sqdn Chaffi's Hill England; 5 O 19 Asst Mtnce Off 104th Aero Rpl Sqdn Issoudun France
Redwood, John P	*CE* '17	15 My 17 to 15 Au 19	1st Lt 48th Inf Madison Barracks and Syracuse NY Newport News Va Markleton Pa Oteen NC and Charleston SC
Reese, Charles E	'20	20 My 18 to 28 N 18	Jn 18 Recvg shipC ambridge Mass; Au 18 Ground School MIT Boston Mass; O 18 Naval Air Sta Miami Fla Chf QM (A) USNRFC; 28 N 18 Inactive Duty
Regula, Albert S	*CE* '14	16 Jl 18 to 11 Jl 19	28 Jl 18 2d Lt 603d Engrs; Au 18 France
Reinecker, Lawrence T	'17	16 Jn 17 to 10 Jn 19	Smn USN; N 17 Ensign Constr Naval Optg Base Norfolk Va
Rice, Clifton E	'23	17 Jl 18 to 28 Ap 19	Pvt E Tr Cp Cp Humphreys Va; 1 N 18 Sgt 219th Engrs Cp Dodge Ia; 28 Ja 19 Sgt Personnel Det
Rich, Melvin S	*CE* '05	12 My 17 to 6 F 19	1st Lt Engrs EOTC; Au 17 Cantonment Constr; F 18 GPA Labor Bureau France
Ridgway, Herbert	*CE* '15	25 Au 17 to 4 Mr 19	Cand 2d OTC Ft Meyer and Ft Monroe Va; 15 D 17 1st Lt CAC Ft Hancock N J; 11 Ja 18 57th Art; 10 My 18 France; 18 N 18 Organ and Tr Cent No 1 Libourne France; 4 D 18 69th Art St Mihiel & Meuse-Argonne
Riker, I Russell	*CE* '15	29 My 18 to Au 19	4th OTC (Art); Jn 18 310th MG Btn 79th Div; Jl 18 Util Det Constr Div Cp Meade Md; 28 S 18 2d Lt
Riley, John P	'21	O 18 to D 18	OTC Ft Hancock Ga

Riordan, F J	'22	O 18 to D 18	SATC CU
Robartes, Leigh	*CE* '09	20 Au 18 to 2 D 18	1st Lt Engrs
Roberts, Fred W	*CE* '17	26 Ap 18 to 28 Jn 19	314th Engrs 89th Div; 1 O 18 1st Lt 318th Engrs 6th Div; 15 My 19 603d Engrs 5th Corps
Roberts, Henry A	'22	O 18 to D 18	SATC CU
Robinson, Cecil S	'21	O 18 to Ja 19	Pvt AS St Paul Minn
Robinson, Donald M	*CE* '19	1 S 18 to 15 Ja 19	Pvt 1st Rpl Rgt Engrs Washington Barracks DC
Robinson, George G	*CE* '14	8 S 18 to 17 D 19	2d Lt SC Cp Meade Md
Rogers, Theodore C	*CE* '16	16 My 18 to 21 Ja 19	Cand FAOTS Cp Taylor Ky; 1 S 18 2d Lt FA Rpl Depot; 20 S 18 117th FA 31st Div USA and France
Rohwer, Carl H	*CE* '13	5 Ja 18 to 10 My 19	1 Jn 18 2d Lt FA; 10 Jl 18 Saumer Art Sch France; 10 O 18 Stu Obs 16th Balloon Co; 3 D 18 Balloon Sch Bordeaux France; 1 Ja 18 18th Balloon Co
Rollow, Thomas P Jr	*CE* '09	2 S 17 to 8 Jl 19	1st Lt EOTC Ft Leavenworth Kan; 10 D 17 112th Engrs; 22 F 18 Div of Constr and For Intermediate Sec France; 15 Au 18 BS No 3 London England
Rose, John K Jr	*CE* '15		106th Co USMC
Rosenfeld, James R	*CE* '18	15 Jl 17 to 29 Mr 19	2d Lt Engrs; Off Constr QM Cp Merritt NJ; 10 Ja 18 305th Engrs Cp Lee Va; 24 Ja 18 26th Engrs Cp Dix NJ; 22 Jn 18 France
Rosenthal, Jules E	*CE* '15		Ord Dept Engr of Tests Army School Pittsburgh Pa
Rothschild, Wilred A	'23	O 18 to D 18	SATC CU
Rounds, Donald McG	*CE* '03	16 S 18 to 19 D 18	1st Lt Engrs Cp Humphreys Va
Rountree, Albert C	*CE* '12	N 17 to Jl 19	1st Lt CAC 16th Anti-Aircraft Sector Cp Eustis Va
Ruhl, David A	*CE* '20	S 17 to 15 S 19	2d ROTC Ft Snelling Minn; 8 N 17 2d Lt 10th FA 3d Div France
Russel, Robert C	*CE* '17	21 S 17 to 16 Jn 19	Corp 314th Engrs EOTC Cp Lee Va; 2d Lt Engrs France
Russo, Pascual	'22	O 18 to D 18	SATC CU
Rust, Wilbur O	'22	22 My 17 to 2 Ap 18	Smn 2d Cl USNRF Newport RI; Chf QM Naval AS USSMA MIT Boston Mass
Ryan, Walter J	*CE* '06	O 18 to D 18	Capt Stu EOTC Cp Humphreys Va

Ryon, Henry .... *CE* '06 .... 15 to 18 O 19
1st Lt Constr Div QMC Util Det Cp Upton NY; N 18 Capt Constr Div QMC in chg of water, sewers, and electricity Cp Bowie Tex

Sagal, Marcus .... '21 .... O 18 to D 18
SATC CU

Sanderson, Albert B Jr .... *CE* '16 .... 17 O 17 to 21 Jl 19
Pvt 25th Engrs France; Corp; Sgt; My 19 Casual Sgt

Sarstedt, Gordon A .... *CE* '15 .... Mr 18 to Ap 19
Aerial Photo Sect Rochester NY and CU Ithaca NY; Au 18 Sgt 13th Aerial Photo Sect Hdq 2d Army Toul France

Saunders, Walter LeR .... *CE* '17 .... 10 Jl 17 to 4 Mr 19
2d Lt AS SC USSMA Ithaca NY; 9 Mr 18 Off of Dir of Mil Aeronautics Washington DC; 10 Jl 18 1st Lt SC (Av) ; 27 S 18 Capt AS

Scacciaferro, S John .... '21 .... Jl 18 to 1 O 18
Pvt EOTC Cp Humphreys Va

Schauffler, Leslie R .... '19 ....
2d Lt Inf ORC

Scheidenhelm, Frederick W .. *AB* '05 *CE* '06 .... 14 My 17 to 19 Au 19
EOTC Plattsburg Amer Univ Washington DC and Cp Humphreys Va; 19 Jn 17 Capt EORC; 6 Jl 17 Active Duty; 6 S 17 303d Engrs Cp Dix NJ; 16 O 17 26th Engrs (det); 22 N 17 W S Off GHQ France; 18 Mr 18 W S Off Hdq 1st Corps; 23 Jn 18 Asst to Chf Engr 1st Army; 26 Jl 18 Asst to Chf Engr 2d Army; 9 Au 18 W S Off Hdq 1st Army; 21 S 18 Major Engrs; 3 O 18 CO 26th Engrs and W S Off 1st Army; 21 O 18 Lt Col Engrs; 30 D 18 CO 26th Engrs Bordeaux France; 24 Mr 18 Office Chf Engrs Washington DC Report on Mat and Troops for W S work in France; 16 Ap 19 Cited by General Pershing for "exceptionally meritorious and conspicuous services as water Supply Officer of the 1st Army AEF"; 20 N 19 Col ERC Inactive Duty

Schempf, Robert .... '20 .... O 18 to D 18
SATC C U

Schmied, Erich E F .... *CE* '15 .... 8 D 17 to 21 Ja 19
Cadet USSMA Princeton NJ; 27 Jn 18 Flying Sch Chanute Field Ill; 2 N 18 2d Lt AS(A) RMA; 1 Ja 19 Love Field Tex

Schoder, Ernest W .... *PhD* '03 .... 15 Au 17 to 2 Ap 19
Capt Engrs Instr 3 4 5th EOTC Cp Humphreys Va; Asst Dir of Trg; Revision of Field Manuals; O 18 3d Engr Tr Rgt; N 18 Office of Chf of Engrs Washington D C

Scholtz, Herman F .... *CE* '06 .... 20 Jn 18 to 2 Ap 19
EOTC Cp Lee and Cp Humphreys Va; 10 S 18 Capt 3d Rpl Co Cp Forrest Ga; 25 S 18 8th Cas Co France; 25 N 19 128th Engrs

Schreiner, Frederick O .... '22 .... O 18 to F 19
USMC

Schroeter, Robert H .... '20 .... 24 O 18 to 1 F 20
HATS Ft Monroe Va; 17 Ja 20 2d Lt HA USR

Schwartz, Christian .... *CE* '14 .... 5 Au 18 to 27 D 18
Pvt Rct Cp Syracuse NY; 25 Au 18 Pvt 1st Cl CWS Edgewood Arsenal Md

Scileppi, Francis P .... *CE* '17 .... 23 Ap 18 to 20 D 18
30 Ap 18 Mach Mate 2d class USNRF; 20 O 18 Ensign

Scott, Owen W .... '22 .... O 18 to D 18
SATC C U

Scott, Thirlestane	'12	My 17 to —	1st Lt 15th Engrs; 9 Jl 17 France
Seaman, Van Brunt	'18	28 Ap 17 to 5 Jl 18	Smn USN USS Emeline Brest France; Jn 18 Ensign; 5 Jl 18 Disch on acc of injuries
Selee, Richardson	'21	O 18 to D 18	SATC C U
Seifried, Charles F	*CE* '09	D 17 to Jl 19	2d Lt 23d Engrs; Ap 18 France; S 18 1st Lt; Meuse-Argonne Off
Senecal, Henry J	'18	15 My 17 to 3 Mr 19	O 17 2d Lt 310th FA Cp Meade Md; S 18 1st Lt 37th FA Cp Lewis Wash
Senior, Frank S	*CE* '96	26 Ja 18 to 3 Jn 19	Major Engrs Trans Corps Staff of Brig-Gen Atterbury AEF Engr of Ports in Chg of development of ports of France for use of AEF. Cited by Gen Pershing for "exceptionally meritorious and conspicuous services"
Sessler, Marcel K	*CE* '13	My 17 to My 19	Oiler; F 18 Ensign USS "Pittsburgh" E Coast of So Amer; D 18 Asst Ch Engr USS "Artigas" Atlantic; F 19 Asst to Ch Engr USS "Kroonland" in French waters
Sewell, Oscar J	*CE* '19	3 F 18 to 13 D 18	Pvt ERC; 19 O 18 SATC C U
Shafer, James C F	*CE* '05	27 Au 17 to 11 D 18	2d ROTC; 27 N 17 Capt CAC; AP 18 104th Rgt with French Army; 6 Jn 18 52d CA France; 2 N 18 Major; Vosges Toul Thierville Les Sartelle St Mihiel Argonne
Shelton, Murray N	*CE* '16	27 Au 17 to 21 Ap 19	Capt FA 5th Corps Art Park France
Sherk, Earl J	'21	O 18 to D 18	SATC C U
Shipman, Linn D	*CE* '14	30 Ap 17 to 18 D 18	Boatswain Mate 2d Class USN; Mr 18 Ensign USS "South Dakota" Convoy work; USS "Hull" Norfolk Va
Shultz, Ralph M	'14		Pvt 502d Btn Engrs; Sgt France
Silsbee, James A	*CE* '07	Ja 18 to —	Constr work Edgewood Arsenal Md; CO Cos K and F 2d Btn Engrs
Simpson, Harold E	'21	O 18 to D 18	SATC C U
Skinner, John F	*CE* '90	16 S 18 to 15 Ap19	Capt Constr Div QMC Hdq Washington DC Dist Supvg and Util Off of Army Cps and Cntmts E of Miss River and N of N C; 1 Ja 19 Hawaiian Dept
Skinner, Robert A	'18	6 Ap 17 to 23 Jn 19	Smn USNRF S P 578; D 17 Ensign Naval Acad Annapolis Md; Jn 18 Ensign and Lt (JG); USS N-5; USS N-6; USS L-11
Sloane, George C	*CE* '12	1 Ap 18 to 26 My 19	Pvt 19th Engrs France
Smallman, Ralph A	*CE* '08	15 My 17 to 18 Jn 19	Cand 1st OTC; 5 Jl 17 1st Lt Engrs; 4 S 17 25th Engrs Cp Devens Mass; 1 D 17 Capt; 27 F 18 1st Army AEF; Meuse-Argonne
Smibert, Robert M	'22	O 18 to D 18	SATC C U

Smith, Arthur L .... *CE* '11 .... 25 Jn 18 to 27 N 18
Pvt Cp Hancock NJ; 1 S 18 Pvt 1st Rpl Rgt Engrs Washington Barracks DC; 25 S 18 Pvt EOTC Cp Humphreys Va

Smith, Charles E .... *CE* 13 ....
1st Lt 301st FA Cp Devens Mass and France

Smith, Eugene R .... *CE* '12 .... 14 My 17 to 9 F 19
2d Lt Inf 76th Div; 80th Div; MTC Staff of Gen Butler BS No 5

Smith, Joseph E .... '20 .... 1 O 18 to 15 D 18
SATC C U

Smith, Stephen H .... *CE* '13 .... 23 Au 17 to 16 My 19
27 N 17 1st Lt 35th Art CAC

Snively, William J .... *CE* '16 .... 11 My 17 to 1 F 19
1st OTC Cp Grant Ill; 14 Au 17 2d Lt 311th Engrs; 20 Au 17 4th Engr Tr Rgt; Instr 2d Corps Sch AEF

Snow, Arch M .... *CE* '06 .... 13 My 17 to 3 Ap 19
OTC Cp Amer Univ DC; S 17 1st Lt 304th Engrs Cp Meade Md; Ja 18 Engrs Sch Langres France; Au 18 102d Engrs AEF

Sollitt, Ralph S .... '15 .... O 17 to 22 S 19
Pvt and NCO 341st Inf; Ja 18 Stu Off 3d ROTC Cp Lee Va; Ap 18 2d Lt CO Co B 61st Engrs; Jn 18 1st Lt ; Jl 18 France; Ap 19 Capt Engrs Adj Rennes Div Trans Corps

Sourwine, James A .... *CE* '12 ....
Capt Engrs USA France

Spafford, James H .... *CE* '17 .... 14 My 17 to 9 O 18
1st OTC Ft Meyer Va; 14 Au 17 2d Lt Amer Univ Washington DC; S 17 Ecole Militaire du Genie Versailles France; N 17 2d Engrs 2d Div; 29 Au 18 1st Lt; O 18 Rec for Capt; 9 O 18 Mortally Wounded at Blanc Mont, died 2 hours later at Suippes; Belleau Woods, Chateau Thierry, Soissons, St Mihiel Blanc Mont Received DSC and Croix de Guerre with Palm

Sparfield, Emil H .... *CE* '12 .... 29 Au 18 to 12 D 18
FAOTS Cp Taylor Ky; 2d Lt FA

Spear, George P jr .... *CE* '16 .... 21 F 18 to 30 Jn 19
Pvt Engrs; 1 My 18 Corp 303d Engrs; 13 Jl 18 Sgt AEF; 27 Jl 18 EOTS France; 1 O 18 2d Lt 303d Engrs 78th Div AEF; Argonne-Meuse Off

Speer, Jacob F .... '13 .... 25 My 18 to 12 O 18
Pvt 90th Cas Div; Jn 18 AEF; 315th Btn 260th San Train; S 18 Machine Gunner 358th Inf; 12 O 18 Killed in St Mihiel Drive

Spence, Thomas R .... *CE* '17 .... 28 Jn 18 to 11 D 18
16 Jl 18 Pvt 1st Engr Rpl Rgt; 16 Au 18 Pvt EOTS; 26 O 18 Sgt and Cand 10th Engr Tr Rgt; 3d D 18 Co 4th EOTS

Spivak, William T .... '20 .... 2 Mr 18 to 14 D 18
ERC; 1 N 18 SATC C U

Spivey, Willis T .... *CE* '10 .... 18 My 18 to Mr 19
1st Lt Engrs

Spragins, William E .... *CE* '08 .... Jn 17 to 1 F 18
Capt Engrs Vancouver Barracks Wash; Major AEF

Stahl, John J .... *CE* '12 .... 1 S 17 to 11 D 17
2d Lt Engrs Amer Univ Washington DC

Stalker, John H .... '19 .... 28 S 17 to 22 Jl 19
23d Engrs Cp Meade Md; 22 Ja 18 Corp France; Oise-Aisne, Aisne-Vesle, Meuse-Argonne Offensive; 1 Mr 19 Am Det Sorbonne Univ Paris France

Stanton, Robert B jr .... *CE* '09 .... 17 Jn 18 to 18 D 18
1st Lt CO Co B 566th Engrs

Stapley, Edward R .... *CE* '14 .... 25 Au 17 to 10 Ja 19
Cand OTC Ft Niagara NY; 27 N 17 2d Lt FA Off Tr Btn Cp Travis Texas; Ja 18 Off Sch Kelley Field Tex; 1 Mr 18 Instr in Aerial Obstn Cadet Wing Sch Kelley Field No 2 Tex; 1 Ap 18 Stu Av Engrg AS Gr Sch MIT Boston Mass; 1 Au 18 2d Lt AS (A) Asst Engr Off Brooks Field Tex; 18 O 18 Adj Post Engr Off; D 18 Stu Liberty Motor Sch Detroit Mich

Stearns, Fred LeR .... *CE* '10 .... 15 Jl 17 to 3 Ap 19
2d Lt 107th Inf; Ap 18 1st Lt 102d Engrs AEF

Steel, Ernest W .... '18 .... 26 O 17 to 18 Jl 19
Pvt 23d Engrs Cp Meade Md; 24 Ja 18 France; 1 Mr 19 Stu Det Univ of Sheffield England

Steele, Gilbert V .... *CE* '10 .... 10 S 17 to 31 D 18
Pvt Hdq Co 302d Engrs; Master Engr; 13 Mr 17 1st Lt 34th Engrs Engr Mach Shop Optn Adv Base No 1 Is-sur-Tille France

Stein, Meyer .... *CE* '17 ....
308th Co 152d Depot Bgde Cp Upton NY; Corp Hdq Co 307th Engrs AEF

Steljes, Martin .... *CE* '15 .... 29 Jn 18 to 13 Jn 19
Chf Machinists Mate USN Str Engr Bur of Yards and Docks Washington DC

Sternbach, J J .... '20 .... O 18 to D 18
SATC C U

Stevens, John H .... *CE* '08 .... 7 D 17 to 12 Jn 19
Pvt 23d Engrs Cp Meade Md; 27 D 17 Master Engr (SG); F 18 France; 9 S 18 2d Lt; 9 My 19 1st Lt

Stibolt, Victor A .... *CE* '11 .... 17 to — —
1st Lt and Capt Ord

Stidham, Harrison .... *CE* '91 .... 23 O 18 to 1 Ja 19
Capt QMC Constr Div

Stoltz, Alexander F .... *CE* '19 .... 13 N 17 to 12 D 18
USSMA Princeton NJ; Dallas Tex; Ft Worth Tex; Garden City NY; 2d Lt AS 346th Aero Sqdn

Storey, Frank S .... *CE* '02 ....
ROTC Madison Barracks NY; 1st Lt Engrs

Stott, Charles A .... *CE* '19 .... 1 O 18 to 15 D 18
SATC C U

Stovall, Harry E .... '20 .... 19 My 17 to 20 Jn 19
Pvt USMC Paris Island SC; 15 S 17 2d Lt USMC Quantico Va; 16 F 18 Av Sect USMC Miami Fla; 1 Jl 18 1st Lt Av USMC; 2 Jl 18 Capt Northern Bombing Group Flanders France

Strahan, Joseph C J .... *CE* '13 ....
1st Lt AS (SC) AEF

Strummer, Samuel .... *CE* '17 .... 4 My 17 to 18 Au 19
OTC Madison Barracks NY; and Ft Monroe Va; Au 17 2d Lt CAC Instr Ft Totten NY; 27 Au 18 1st Lt; 6 O 18 48th Art AEF; Mr 19 Sorbonne Univ Paris; 6 D 19 1st Lt CARC Inactive Duty

Suits, Henry J .... '14 .... 2 Au 18 to 13 Ja 19
Ch Mach Mate USNRF; 12 D 18 Machinist

Sullivan, Michael G .... '21 .... O 18 to D 18
SATC C U

Summers, Richard E J .... *CE* 14 .... 7 Jn 17 to 29 Mr 19
1st Lt 15th Engrs Constr; 9 Jl 17 France; Jl 18 Capt 9 S 18 Cp Humphreys Va

Sundstrom, Charles A .... '21..............................
USNRF

Supplee, George W ....*CE* '15.....................1 N 17 to 15 Au 18
Capt Engrs Russian Ry Ser Corps Vladivostok Siberia

Swerdlove, Louis ....*CE* '17...................15 My 18 to 14 D 18
Pvt 1st Cl 4th OTS and FACOTS; 1 S 18 2d Lt FA Rpl Depot Cp Jackson SC; 22 S 18 FA Sch of Fire Ft Sill Okla

Swick, Charles H ....*CE* '10..........................
Capt 33d Engrs AEF

Symmes, Henry W..............'20 ....
Canadian Volunteers Res

Symonds, George R ....*CE* '09....................17 F 17 to 5 Au 19
Capt ERC; 11 F 18 EOTC Cp Lee Va; 18 Jn 18 605th Engrs and Rgtl Adj Cp Forrest Ga; S 18 8th Army Corps France; D 19 Capt EORC Inactive Duty

Taliafero, Edward H jr ....'10 ....
Maj 17th Engrs (Ry)

Tate, Robert L H ....*CE* '12....................5 My 17 to 26 Jn 19
EOTC Madison Barracks NY and Amer Univ Washington DC; 27 Au 17 1st Lt 303d Engrs Cp Dix NJ; 12 Jl 18 Capt and Adj 1st Btn 303d Engrs France; 19 Ap 19 CO Co A 303d Engrs; St Mihiel and Argonne

Taussig, John W ....*CE* '08....................15 O 18 to 27 N 18
EOTC Cp Humphreys Va

Taylor, Albert M ....*CE* '15....................10 My 17 to 4 D 18
15 Au 17 2d Lt 311th FA; 1 My 18 FA Rpl Depot; Jl 18 1st Lt Sch of Fire Ft Sill Okla; 6 S 18 65th FA

Taylor, Edward H ....*CE* '12...................11 My 17 to 17 Jn 19
20 S 17 Capt Engrs, Aide to Gen M M Patrick France

Taylor, Roy ....*CE* '10....................21 F 18 to 25 Au 19
Capt Engrs; Mr 18 Gen Staff G-I Hdq SOS AEF in chg of Shipping Sec; Au 18 Major Engrs; N 18 repr with Army in France of Shipping Control Comm of NYC; Ja 19 Genl Staff in connection with Repatriation of AEF; 7 Ap 19 awarded Legion d'Honneur by Marshall Petain

Taylor, S LeRoy ....*CE* '13....................28 D 17 to 12 Ap 18
2d Lt Engrs EOTC Cp Lee Va

Tehan, Joseph J ....*CE* '09.......................... to
1st Lt Engrs

Ten Hagen, Henry ....*CE* '13...................15 My 17 to 11 Jl 19
OTC; 15 Au 17 2d Lt 303d Engrs; N 17 2d Engrs AEF; 1 S 18 1st Lt 3d Engrs Highway Work Panama CZ

Terhume, Elmer S ....*CE* '09.......................———8 N 18
OTC Ft Sheridan Ill; 2d Lt FA Killed in action 8 N 18

Terrill, Leslie R.................'17...........................
303d Engrs Cp Dix NJ

Theard, Stephen A..............'17........................3 Jn 17 to 5 N 19
Chf Boatswain Mate USNRF Asst Pub Works Off Navy Yard New Orleans La; 1 My 18 Smn Patrol Duty Southern Waters; 10 Au 18 Ensign

Thiele, Claude M ....*CE* '11..................... 21 D 11 to date
2d Lt Ft Monroe Va & Puget Sound Wash; 16 1st Lt CAC Mexican Border; 17 1st Lt Jefferson Bks Mo; Capt Rec Ser CAC; 18 Major CAC Adj Genl's Office Washington DC; 19 AEF Paris; Off Adj Genl Army of Occ Coblenz Germany

Thomas, Edwin R . . . . . *CE* '09 . . . . . 30 My 17 to 28 F 19
Pvt Corp Sgt 14th Engrs Salem N H; Au 17 France 1st Lt; 20 Jn 18 116th Engrs; Lt Rys & Div Engrs British French & Amer

Thomas, Joseph A . . . . . '20 . . . . . My 17 to 9 S 19
1st OTC Ft Niagara NY; 2d Lt 312th FA; Jl 18 304th Amm Train France

Thomas, William R . . . . . '21 . . . . . 20 Jl 18 to 20 Ja 19
16 S 18 2d Lt Inf SATC Univ of Georgia; 2d Lt Med Dept

Thomassen, Victor G . . . . . *CE* '11 . . . . . 14 My 17 to 4 D 18
EOTC Plattsburgh NY; 17 Jl 17 1st Lt Engrs Cp Upton NY; 27 Au 17 302d Engrs 77th Div Cp Upton & France; 25 Ja 18 Capt 27 Au 18 Major 5th Engr Tr Rgt Cp Humphreys Va

Thomen, Paul W . . . . . '23 . . . . . 3 O 18 to 1 F 19
SATC C U Ithaca NY; 10 O 18 OTC Cp Taylor Ky; 1 F 19 2d Lt FA USR

Thompson, Alexander M . . . . . *CE* '13 . . . . . 8 My 17 to 17 Jn 19
1st Lt Engrs RC; Capt Engrs; 28 Au 17 313th Engrs

Thompson, Chester A . . . . . *CE* '16 . . . . . 15 D 17 to —
Pvt 29th Engrs; O 18 Corp; N 18 2d Lt

Thompson, Ewing . . . . . *CE* '14 . . . . . 8 N 17 to 25 Jn 19
Pvt 23d Engrs (Hwy)

Thompson, George R . . . . . *CE* '17 . . . . . D 17 to Ap 20
USSMA CU Ithaca NY 2d Lt AS

Thweatt, Hardin H . . . . . *CE* '13 . . . . . 26 Au 18 to 27 N 18
Corp EOTC Cp Humphreys Va

Tierney, John F jr . . . . . '21 . . . . . 6 O 18 to 26 O 18
Pvt Co L 1st Rgt Cp Taylor Ky; 26 O 18 Died of pneumonia

Tillotson, Edwin H . . . . . *CE* '17 . . . . . 27 Au 17 to 11 Jn 19
15 D 17 2d Lt 21st FA 5th Div; 15 D 18 19th FA; 25 Ja 19 21st FA 5th Div; 13 O 18 1st Lt FA

Todd, Kirkland W . . . . . '18 . . . . . Ap 17 to Au 19
Capt AS AEF Argonne

Tolles, Frank C . . . . . *CE* '05 . . . . . 30 Ap 17 to 16 Ap 19
Pvt 112th Engrs 37th Div; 15 Jl 17 Corp; 1 Au 17 Sgt; 1 S 17 Sgt 1st Cl; 15 N 17 1st Lt; 13 N 19 Capt Top Off Awarded Croix de Guerre and Corps Citation "for exceptional bravery in making a reconnaissance for pontoon bridges."

Toms, Raymond E . . . . . *CE* '07 . . . . . 17 to 19
Capt 127th FA Kelley Field Tex 15 mos and AEF 3 mos

Torrance, Robert S . . . . . *CE* '16 . . . . . 8 S 17 to 5 Au 19
Master Engr (JG) 25th Engrs; 14 O 18 2d Lt 122d Engrs; 2 Jn 19 1st Lt Engrs

Torrance, William M . . . . . *CE* '95 . . . . . 14 O 17 to 19 Jl 18
Capt 23d Engrs (Hwy); 28 D 17 Asst to Constr QM at Raritan Arsenal NJ

Townsend, David W . . . . . *CE* '15 . . . . .
2d OTC Schofield Barracks Hawaii; Lt 3d Engrs

Triest, William H . . . . . '22 . . . . . O 18 to D 18
SATC C U

Trimpi, Allen L . . . . . *CE* '10 . . . . . 18 Mr 17 to 8 Ja 19
OTC Cp Dix N J; 4 Jl 17 Cp Lee Va; 17 Au 17 1st Lt 104th Engrs Anniston Ala; Jn 18 1st Lt Ord Dept

Troxell, Willard W . . . . . *CE* '14 . . . . . 14 My 17 to 28 My 19
10 S 17 1st Lt 104th Engrs

Tunnicliffe, John C..............*CE* '17.....................1 Ja 18 to 26 Jn 19
Pvt Engrs; Corp; Sgt; 1st Sgt; 2d Lt; 1st Lt Engrs; 1 F 18 42d Engrs; 15 Au 18 20th Engrs

Turner, I A ....'12.....................10 My 18 to 22 Mr 19
Corp 74th Engrs

Turner, William J ....*CE* '07..........................
Capt AS

Underwood, Bert O ....'22.............................O 18 to D 18
SATC C U

Underwood, W L ....'23.............................O 18 to D 18
SATC C U

Urquhart, Leonard C ....*CE* '09...................15 My 18 to 3 Mr 19
4th OTS Cp Meade Md; 7 Jn 18 2d Lt Engrs EOTS Cp Lee Va; 30 Jl 18 6th Engr Tr Rgt Cp Humphreys Va; 28 S 18 215th Engrs Cp Humphreys Va and Cp Logan Tex

Vaiden, Cowles M ....'13.......................3 Ap 18 to 21 Ja 19
Pvt Ord C Gunpowder Reservation; CWS Edgewood Arsenal Md

Valderama, Manuel A ....*CE* '18........................O 18 to D 18
SATC C U

Van Camp, Paul M ....'20.....................26 Au 18 to 31 D 18
MG Tr Center Cp Hancock Ga; 4 N 19 19th Div Cp Dodge Ia

Van de Mark, Otis S ....*CE* '10....................25 Jl 18 to 15 F 19
Capt AS Sup Div Washington DC Chf of Bldgs & Grds Br

Vandevanter, Elliott ....*CE* '08..................17 My 17 to 21 Au 19
S 17 Capt 503d Engrs; O 18 Unattached

Van Valkenburg, Paul I..........'20.............................O 18 to D 18
SATC C U

Vieweg, Fred jr.................*CE* '11..................25 Au 17 to 24 Mr 19
Cand OTC Plattsburg NY; 25 Au 17 Capt Ord Dept; 4 Mr 18 Gen Staff Int Div Washington DC; 8 Au 18 Siberia

Vieweg, Otto C ....*CE* '16...................29 Au 18 to D 18
Pvt AS Madison Barracks NY; Sgt Photographic S ASA Rochester N Y

Vincent, Charles R ....'08............................
1st Lt USSC

Vivoni, Armando ....*CE* '15.........................F 18 to D 18
OTC San Juan PR; Ap 18 1st Lt Inf Cp Las Casas PR

Vogelson, John A ....*CE* '00...................10 Ja 18 to 11 D 18
27 Ja 18 Major San C Cp Greenleaf Ga; 13 F 18 Cp Joseph E Johnson Fla

Volpe, Innocent J ....'22.............................O 18 to D 18
SATC C U

Volz, Charles A ....*CE* '11..................11 My 17 to 11 D 18
15 Au 17 1st Lt Co E 302d Engrs 77th Div Cp Upton N Y; 30 Jl 18 Capt; 15 S 18 Instr (E)OTS Cp Humphreys Va; 29 Mr 18 AEF

Wait, Robert S ....*CE* '13...................27 Au 17 to 22 Ja 19
15 D 17 1st Lt 301st FA

Walbran, Nicholas A ....*CE* '18.....................5 My 18 to 19 S 19
Pvt EOTC Cp Lee Va; Jl 18 2d Lt 22d Engrs Ft Benj Harrison Ind; S 18 118th Engrs France 16th Grand Div Trans Corps

Wales, William H...............*CE* '12..........................
51st Aero Sqdn AEF

Walker, Carl H .... *CE* '18 .... 11 D 17 to D 18

CM 2d Cl USNRF Trans New York City; My 18 Cadet AS USNRF Boston Mass; S 18 Flying Cadet Akron Ohio

Wall, James J jr .... *CE* '16 .... 12 My 17 to 19

1st Lt OTC Plattsburg NY; 17 Jl 18 6th Engrs; Au 18 1st Lt and Capt 2d Engrs; Awarded Croix de Guerre Champagne Sector

Wallace, Aaron V D jr .... '20 .... 28 My 18 to S 18

Pvt CAC Ft Monroe Va; 25 S 18 2d Lt CAC Coast Defense of Southern NY

Walter, David S .... '22 .... O 18 to D 18

SATC C U

Warner, Frederic W jr .... '23 .... 23 D 17 to 13 Au 19

Sgt USMC 14 mos overseas

Warner, Howard S .... *CE* '11 .... 15 My 17 to 21 Jl 19

1st EOTC Ft Leavenworth Kan; 24 Jl 17 2d Lt Engrs; 14 Au 17 Capt 315th Engrs 90th Div Cp Travis Tex; Jn 18 France; St Mihiel and Argonne-Meuse offensives; Army of Occ Germany; My 19 G-5 Athletics Genl Hdq Paris; 9 Jl 19 Cp Shelby Miss

Warner, Loring K .... *CE* '10 .... 15 My 17 to 21 Jl 19

OTC; 15 Au 17 1st Lt 308th Engrs; 1 N 17 106th Engrs; 14 S 18 Capt 106th Engrs AEF; Engr Sch Chatillon-sur-Seine and Langres France; 15 D 18 CO Co E 106th Engrs Constr Work Cp Pontanezan France

Watkins, Charles B .... *CE* '15 .... 6 Jn 17 to date

Smn 2d Cl USNRF Norfolk Va; 5 O 17 Ensign Hampton Roads Va; 6 D 18 Lt (JG) CE Corps USN Sub Base Constr Hampton Roads Va

Watkins, Frederick H .... '11 .... 18 Jl 18 to 29 N 18

Pvt Engrs Ft Benj Harrison Ind; O 18 Cand Cp Taylor Ky

Weatherson, John .... *CE* '95 .... 14 My 17 to 17 Ap 19

Capt 338th Inf 85th Div; Cited in operations of the 2d Army between the Meuse and Moselle Rivers N 18

Webb, Seth W .... *CE* '06 .... 8 My 17 to 17 F 19

1st OTC Ft Benj Harrison Ind and Ft. Leavenworth Kan; F 18 1st Lt 3d Engrs Hawaii; Jl 18 Capt Engrs

Webb, Walter L .... *CE* '84 *MCE* '89 ....

Major Engrs France

Weber, Richard E .... *CE* '18 .... 20 Ap 18 to 29 Ap 19

Sgt 1st Rpl Rgt Engrs Washington DC; S 18 Sgt SARD France and England

Weedon, Hugh H .... '22 .... O 18 to D 18

SATC C U

Weir, Robert H .... '20 .... O 18 to D 18

SATC C U

Weiss, Bertrand .... *CE* '09 .... 18 to 19

Lt (JG) Naval Ord Washington DC

Weiss, Charles .... *CE* '13 .... 7 My 17 to 29 Jl 19

OTC Ft Niagara N Y; Au 17 2d Lt 304th Engrs Accontik Va; F 18 1st Lt; Ap 18 Capt 66th (Ry Optg) Engrs; Adj St Florentin Div Trans Corps

Welch, Allen L .... '20 ....

USNRF

Welles, Theodore L jr .... *CE* '13 .... 25 S 17 to 2 Au 19

EOTC Ft Leavenworth Kan; N 17 2d Lt ERC; D 17 5th Engrs Corpus Christi Tex; 1 Ja 18 318th Engrs 6th Div Vancouver Barracks Wash; My 18 France; S 18 314th Engrs 89th Div St Mihiel and Meuse-Argonne; 21 N 18 1st Lt 318th Engrs 6th Div France and Germany

Wells, Edward H jr ....*CE* '10....................9 O 17 to 7 Au 19
Pvt 302d Engrs; Sgt (E)ROTC; Ap 18 2d Lt CO Co B 518th Engrs; 22 Jn 18 1st Lt; 1 N 18 Pers Adj Army Engr Sch AEF; 1 F 19 Exec Off to Col Bond G-5 GHQ; 1 My 19 Capt

Wells, Laurence R ....'21..........................O 18 to D 18
SATC C U

Welsh, Russell D ....*CE* '13...................28 My 18 to 24 Jl 19
Pvt 115th Engrs; 1 Au 18 Pvt 1st Cl; 14 S 18 Corp France; 1 O 18 Cand (E)OCT Langres France; 28 Mr 19 2d Lt 115th Engrs 3d Army of Occ Germany

Werner, Victor H ....*CE* '14....................30 Au 18 to 7 D 18
Pvt Cp Util Constr Div QMC

West, Karl G ....'19........................My 17 to 5 N 18
2 Mr 18 1st Lt; Pilot 20th Aero Sqdn; Killed in action 5 N 18; Recommended for DSC

West, Randolph C .... 20.........................1 O 18 to 15 D 18
SATC C U

Whipple, John B ....*CE* '07....................10 S 18 to 1 My 19
1st Lt Engrs Constr Div in Chg Road Constr and Rep Cp Humphreys Va

White, Frank M ....*CE* 11....................24 Jl 18 to 15 Mr 19
1st Lt Constr Div Curtis Bay Ord Depot Md

Whitlock, Edgar M ....*CE* '10....................8 My 17 to 26 S 18
Pvt 18th Engsr (Ry); My 17 1st Lt American Lake Wash; 8 Jl 17 AEF; N 17 Engr Off Paris; Jl 18 OTC; Au 18 102d Engrs 27th Div; 26 S 18 Killed in Action Citation for Meritorious Services

Whitman, Ezra B...............*CE* '01....................8 S 17 to 7 Mr 19
Major Asst CO Constr Cp Meade Md; 10 O 17 CO Util; 17 Ap 18 Constr QM

Whitney, Charles S ....*CE* '14........................D 17 to Jn 19
Sgt 25th Engrs; Mr 18 France

Whitney, Howard E ....'22........................2 O 18 to 21 D 18
SATC C U

Whitney, Leonard H M ....*CE* '08.........................
1st Lt 303d Engrs AEF

Whittier, Paul F................*CE* '16...................15 D 17 to 15 Ja 19
Corp 1st Rpl Engrs; 7 mos AEF SARD Engrs as Sgt

Wilgus, Herbert S ....*CE* '01...................10 S 18 to 18 D 18
Major Engrs

Williams, Alan F ....*CE* '15....................13 Jn 17 to 6 Jn 19
Pvt 18th Engrs (Ry) American Lake Wash & enroute to France; Au 17 Master Engr Hdq Co 18th Engrs Bordeaux France; Mr 18 St Sulpice France; Au 18 Army Scho of Line Langres France; O 19 Army Genl Staff Coll F 19 18th Engrs (Ry) Beau Desert France

Wilson, Calvin L ....*CE* '12....................24 Jn 18 to 23 Ja 19
Pvt and Corp 165th Depot Brigade; 23 Ja 18 Pvt 1st Cl 472d Engrs

Wilson, Edgar M ....*CE* '10.....................12 Ja 18 to 27 Jn 19
Pvt Ord Stores Course Univ of Penn Philadelphia Pa; 26 F 18 Pvt Ord Dept Augusta Arsenal Augusta Ga; 12 Ap 18 Pvt Ord Tr Cp Cp Hancock Ga; 21 Jn 18 Ord MG School Cp Hancock Ga; 12 S 18 2d Lt M & RS Cp Raritan NJ

Wilson, Harry ....*CE* '08......................25 S 17 to 1 Jl 19
Engrs OTC Cp Amer Univ Washington DC; 10 D 17 304th Engrs Cp Meade Md; 25 S 17 1st Lt Engrs; 27 D 17 510 Engrs Cp Lee Va & AEF; 16 Ap 19 Capt Engrs

Wilson, Percy S . . . . *CE* '18 *MCE* '20 . . . . Jn 18 to 27 N 18
Engr R; 1 N 18 Engr OTC Cp Humphreys Va

Wing, Charles B . . . . *CE* '86 . . . . 15 Jn 17 to 14 Jn 19
Major Engrs Tr Cp Vancouver Barracks Wash; 2 S 17 23d Engrs (Hwy); 15 O 17 Lt Col; Mr 18 France; 24 O 18 1st Army Argonne & Meuse

Winship, Arthur W . . . . *CE* '19 . . . . 2 My 17 to 3 Ja 19
2d Lt 39th Inf; 2d Lt CAC Ft Monroe Va and Ft McArthur Calif; 1st Lt; Capt

Wolff, Edward J jr . . . . '17 . . . . 12 Jn 14 to 16 Au 18
12 Jn 14 West Point; 30 Au 17 2d Lt 16th FA; 1 Mr 18 1st Lt; 10 My 18 France; 16 Au 18 Killed at Chery Chartreuse while trying to extinguish fire in his battery's ammunition dump caused by enemy plane dropping incendiary bombs; 29 Mr 19 Cited by Gen Pershing

Wood, Alfred R . . . . '21 . . . . Mr 18 to 4 Au 19
USNRF

Wood, Edward A . . . . *CE* '08 . . . . 12 My 17 to 18 Jl 19
23 Jn 17 1st Lt Engrs Tr Cp Ft Leavenworth Kan; 15 Au 17 Capt 315th Engrs Cp Travis Tex; France; 26 Ap 18 Major; Cited for bravery

Wood, Percy H . . . . '20 . . . . 6 Jn 17 to 15 Ap 19
Pvt 7th Rgt EC Tr to Co D 17th Engrs (Ry): Jl 17 Corp AEF

Woodbury, Bicknell J . . . . *CE* '19 . . . . Ap 17 to Ja 19
2d Lt ROTC Madison Bks NY; FA School Saumar France 1st Lt 15 FA 2d Div France; 49th FA Cp Bowie Tex

Woodruff, Charles C Jr . . . . *CE* '20 . . . .
Ensign N A S

Woodruff, Glen B . . . . *CE* '10 . . . . 2 S 17 to 14 F 19
1st Lt Engrs EOTC Amer Univ Washington DC; 12 D 17 1st Rple Engrs Washington Bks DC; 1 F 18 32d Engrs Cp Grant Ill; 1 Jn 18 France; 1 Au 18 Det Ser BS No 2 Bordeaux France

Wright, Chilton A . . . . *CE* '19 . . . . O 18 to D 18
SATC C U

Wright, Ehrick H . . . . '21 . . . . 21 Jn 17 to 15 My 19
Pvt Med C Chateauroux France

Wright, George C . . . . *CE* '03 . . . . 25 O 18 to 1 F 19
Capt Engrs USA

Wright, Harold B . . . . *CE* '14 . . . .
Sgt 23d Engrs

Wurts, John J . . . . '23 . . . . O 18 to D 18
SATC CU

Wyckoff, Norman R . . . . '17 . . . . Ap 17 to — —
16th Engrs (Ry) AEF

Zabel, Oscar E F . . . . *CE* '15 . . . . 8 Jn 18 to 7 F 19
Pvt EOC Det Ser

Zambrana, José A . . . . *CE* '15 . . . . 8 Jn 18 to 7 F 19
Cadet 3d OTC Cp Las Casas PR

Zander, Roy J . . . . *CE* '17 . . . . 12 Au 18 to 22 D 18
Smn 2d Cl USNRF

Zieget, Julius . . . . *CE* '10 . . . . 6 Ap 17 to 27 Au 19
Ensign USNRF; 16 Ap 17 Ex Of N Sec Base Cape May NJ; 1 My 17 Comdt; 1 Ja 18 Lt (JG); N 18 Lt (SG)

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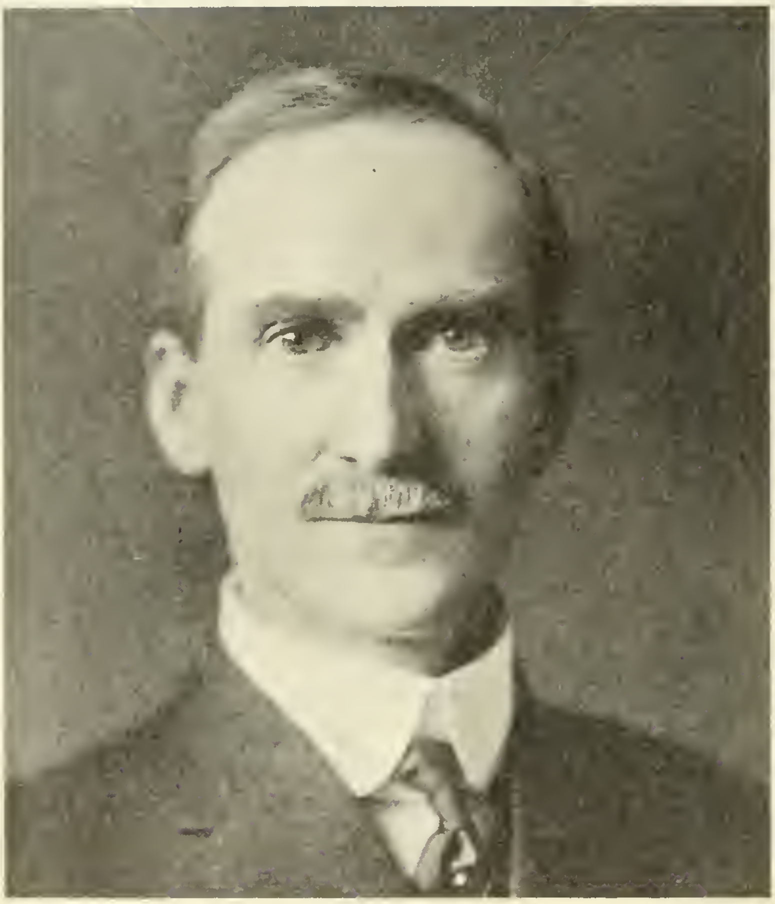

PROFESSOR DEXTER S. KIMBALL

who will be Dean of the College of Engineering when Sibley College and the College of Civil Engineering combine. Professor Kimball has an enviable record as head of the Department of Industrial Engineering and is wonderfully popular both with students and Faculty members.

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EDITORIALS

Civil Engineering

The Class of 1924 will be the first class to enter the new College of Engineering at Cornell. In the minds of those most intimately connected with the new college, the excessive amount of discussion which has arisen over this combination of Sibley College and the College of Civil Engineering has caused an undue amount of emphasis to be placed on this action.

The College of Civil Engineering is not losing its identity; Dean Kimball has repeatedly stated that our college activities should be kept entirely separate as in the past; the C.E. Graduates will be no better posted on the method of designing a double-expansion steam engine, nor any less familiar with the design of a plate girder bridge; in fact, about the only change in the course itself is the introduction of a three-hour course in Shop Work for the C. E. Freshmen, and a three-hour course in Surveying for the Sibley Freshmen. In the latter part of the course there is no change whatever, and the men who decide to stick to Civil Engineering branch of the new College will be graduated with just as good a C. E. degree as those who have gone before.

The Spirit of Combination and Amalgamation is not limited to the Campus, however. From New York we hear very decided rumors that the Cornell Society of Civil Engineers proposes to become the Cornell Society of Engineers and open its doors to the Sibley graduates; and if we go beyond the confines of Cornell we find the various national engineering societies urging the formation of one grand all-inclusive association. But in this general agitation for combining, numerous dissenting voices are heard, and the majority of these voices are from those holding C. E. degrees. Civil Engineers are a clannish lot, and always have been; they are far less numerous than the Mechanical Engineers, and the members of the various groups are held to one another by bonds of far greater intimacy than are those of the other professions; and, further-more, they feel that their particular field of engineering is still separated from the others by a very broad gulf. The electrical engineer and the factory engineer may have much in common; but the civil engineer is quite another proposition.

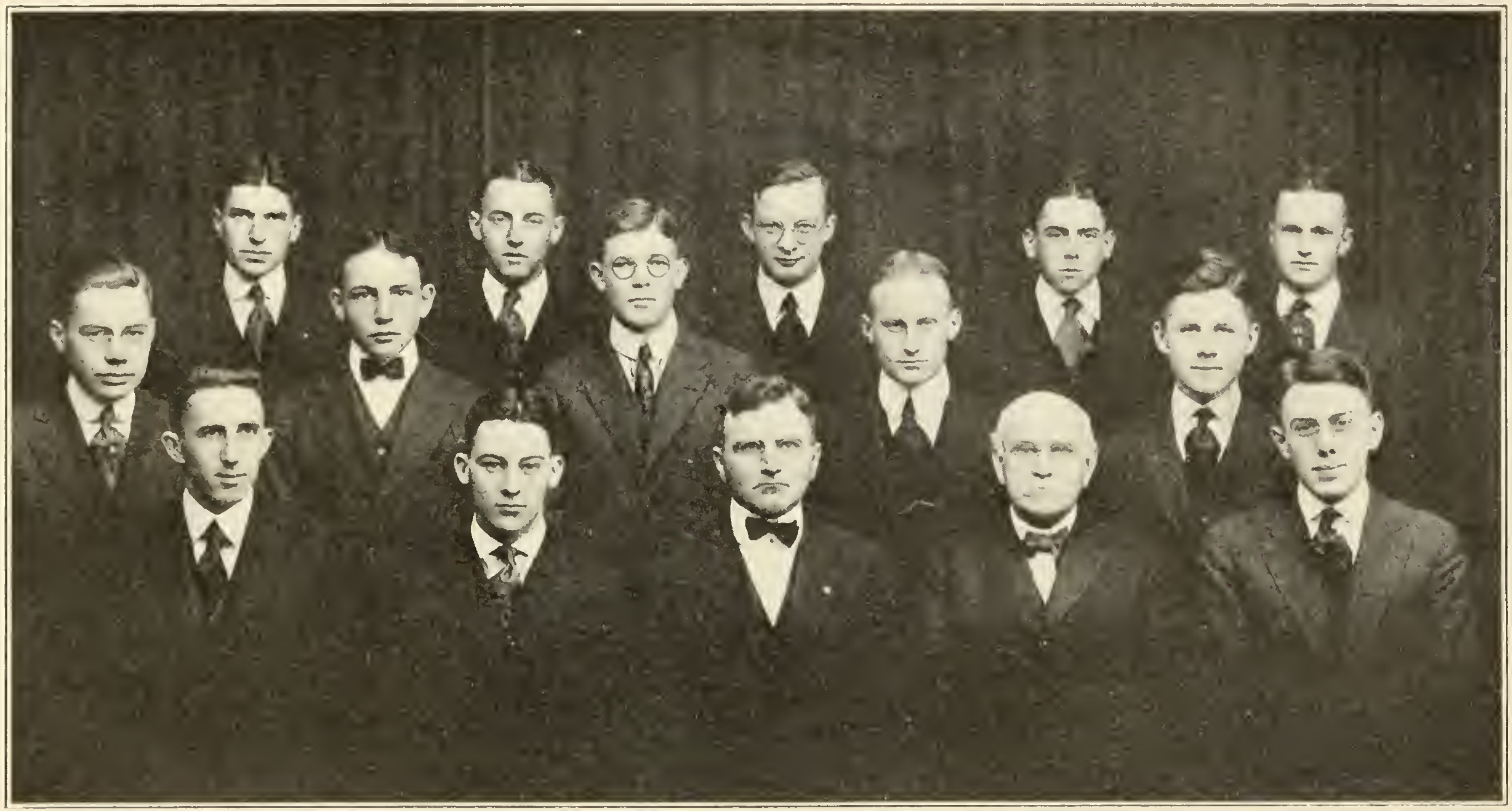
We find this to be the case the world over; it is very significant that in England, where the engineering professions with the exception of civil engineering, are more or less combined,—the C. E. degree carries with it an appreciable amount of distinction which the others lack. Civil Engineering has always been for C. E. men; let us keep it so.

Standardization

Beginning with the October, 1920, number the CORNELL CIVIL ENGINEER will appear with a standard size page of seven-by-ten inches. This change is being made largely at the request of the Advertising Department which has found that many advertisers use standard "cuts" for their advertising and refuse to place an advertisement in a magazine which is unable to use their cuts. The change to a 7 x 10 page will make it possible for us to approach a greater number of advertisers.

The magazine will contain fewer pages next year but, as the printed page is twice as large as it is at present, there will be considerably more reading matter; and we hope to make this reading matter of the greatest interest to all of our readers. The Alumni and College Notes will be kept strictly up-to-date, and will be as all-inclusive as it is possible to make them; every alumnus, whether a subscriber or not, will be communicated with at least once during the year in order that he may, through the columns of the CIVIL ENGINEER, notify his classmates as to his whereabouts and his progress in the profession.

A number of our readers will receive letters from us asking them to write an article for publication; in this respect, the support this year has been very fine and we hope it will be even better in the future. We would particularly appreciate short descriptions of work on particular jobs, the methods employed and the results obtained; cost data on construction work would also be greatly appreciated. Those of our readers who are familiar with the work on various pieces of construction, do not wait for us to find out about it and write to you! Send us a description of the work at once and you may feel assured that it will receive courteous and favored consideration.



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Bethlehem Shipbuilding Co Fore River Plant Quincy Mass
Bright, William R. . . . . *CE* '00. . . . . .5716 Cates Ave St Louis Mo
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Gen Supt H C Brooks Co Inc Martinsburg W Va
Brower, Gerald E . . . . *CE* '16. . . .MFAA 349 Rugby Road Brooklyn N Y
Capt 3d Field Art Camp Grant Rockford Ill
Brower, Irving C . . . . *CE* '01 MASCE MAWWA Barrypoint Rd River-
Major Q M C Constr Div 7th & B Sts S W Washington D C [side Ill
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Brown, Collingwood B Jr . . . . . *CE* '01. . . .MASCE MAREA MEIC Ithaca N Y
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Real Estate 53 Arcade
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Constr Dept Turner Constr Co of N Y C Shawsheen Mills Andover Mass
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Cesario, Frank ....*CE* '16......c/o Antonio Cesario Port ChesterN Y
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Chen, Poo Wha ....*PhD* '17................Yungting Fukien China
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Treas & Chief Engr Alphons Custodis Chimney Constr Co Bennett Bldg N Y C
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Captain U S A 9th Engrs El Paso Texas

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Cowan, Lewis A...... ..*BCE CE* '05.........Blackmore Apts Bozeman Mont
Civil Engineer Construction Northern Pacific Ry
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Cashier Shepherd Engrg Co
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Curtiss, R Elmer . . . . *CE* '04. . . . . 181 Whitney St Hartford Conn
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Dawson, Francis M.....*BS in CE MCE* '13 AMEIC MASTM Truro Nova Scotia
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Decker, A Clinton ....*CE* '09....MAPubHA MAWWA Prince Bay N Y
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Degling, Albert O..............*CE* '20...........173 No 15th St E Orange N J
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Farmer
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Engineer Storm King Highway
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*DeWitt, John ....*CE* '17........Broadmore Colorado Springs Colo
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Construction Engineer Chile Exploration Co Tocopilla Chile
Dickens, Wayland ....*CE* '09...........................Alpine N Y
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*Dillenbeck, Arvin J ....*CE* '11..........AMASCE 50 Wellington Rd
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Power Specialty Co 111 Broadway New York City
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Hou, C. Y .... *MCE* '19........... 31 Zan Ka Da Soochow China
Grad Student College of CE Cornell Univ Ithaca N Y

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Extra Observer U S Coast & Geod Survey Washington D C

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Howard, Thomas .... *CE* '01........................ Portland Conn
Asst Engr N Y State Highway Comm Watertown N Y

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Instructor in Civil Engrg Cornell Univ Ithaca N Y

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Retired

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Street Superintendent & City Engineer

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Superintendent Timber Preserving Plant B R & P Ry Co

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Hyd Engr U S Geol Survey
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Hoyt, William G .... *CE* '09 AMASCE 4618 So Salina St Syracuse N Y
District Engr Water Resources Branch U S G S Madison Wis
Hsu, Yush S .... *CE MCE* '12............ *Tung Wu Col Soochow China*
Asst Engr Canton Hankow Ry Changsha Hunan China
Hu, Tung Chao.... *BS in CE MCE* '05.............. MChES *Shanghai China*
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Huang, Chia-Chi .... *MCE* '18 . MSSCh MChES c/o SY Tsu 22 E Yoa Chia
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President & General Manager Carbon Mining Co Carbon Ind [Ind
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Hulburd, Lucius S .... *CE* '03............ AMASCE Brasher Falls N Y
Senior Asst Engr N Y State Engrs 50 Triangle Bldg Rochester N Y
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Hunkin, Alger E.............. *CE* '20......... 17830 Lake Ave Cleveland Ohio
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Hunt, Sidney E .... *CE* '94...................... Portlandville N Y
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Hurlbut, Hinman B .... *CE* '01........ MASCE 125 Elm St Montclair N J
Hurley, John P .... *CE* '07.......................... AMASCE
Hurley, John W .... *CE* '10......... 2012 Harbert Ave Memphis Tenn
Junior Engineer U S Engineer Office Charge Revetment Constr
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Res Engr E I Du Pont de Nemours & Co Box 282 Newark Del
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Hyatt, Edward K .... *CE* '10......................... St. Louis, Mo
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Hyde, Alfred T .... *CE* '73.......................... Lorton Va
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Hyde, Edward W .... *CE* '72 *MCE* '74........ MAIA 814 Lincoln Ave
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President Young & Hyde Inc Prod Exch Bldg New York City
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Constr Dept Turner Constr Co 244 Madison Ave New York City
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Jackson, Leon E ....*CE* '10..........................Greene N Y
Engineer Roch Ry & Lt Co Rochester N Y
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Engineer American Bridge Co Ambridge Pa
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Division Engineer Transit Constr Comm
*Jacoby, Hurlbut S......*AB* '08 *CE* 10...AMASCE 6523 Euclid Ave Cleveland O
Secretary & Chief Engineer H K Ferguson Co
*James, Robert L ....*CE* '12.....JASCE MSPEE 21 W 93d St N Y C
Tech Dept Vacuum Oil Co 39 Rua da Horta Secca Lisbon Portugal
Janney, William H............*CE* '74.........1815 No Charles St Baltimore Md
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Engineer Petroleum Refining Co
Jaret, Milton............*AB* '13 *CE* '14...........1957 85th St Brooklyn N Y
Jarvis, George M ....*CE* '78......742 E Penn Ave San Antonio Tex
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Jenkinson, Richard D.........*CE* '07...........49 No Tremont St Bellevue Pa
Real Estate and Insurance
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Resident Engineer The Foundation Co Ltd St Jerome P Q Can
*Jenrick, William F ....*BS CE* '10..AMASCE 113 White St Waverly Mass
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Johnson, Albert T Jr..........*CE* '11.........923 No Madison Ave Peoria Ill
Plant Engr Great Western Electro-Chem Co Pittsburgh Calif
Johnson, Berkeley ....*CE* '20....... ..93 Fairfax Road Worcester Mass
Johnson, C Reid ....*CE* '13............2902 St Paul St Baltimore Md
Lieut (jg) CEC USN Submarine Base New London Conn
Johnson, Donald S ....*CE* '15............Evanston Hotel Evanston Ill
Johnson, Eugene C ....*CE* '05.........686 Catalina St Los Angeles Calif
Chief Engineer Pacific Elec Ry Co
*Johnson, Harvey S ....*CE* '11......JASCE 65 Sussex St Port Jervis N Y
Construction Engineer Bossert Corp 1408 Oneida St Utica N Y
Johnson, Hollister ....*CE* '12................AMASCE Dryden N Y
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*Johnson, James A ....*CE* '13.........................Warsaw N Y
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*Johnson, Lawrence .... *CE* '01 .... Collinsville Conn
Civil Engineer
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Merchant
Johnston, Miles C...... *AB BS CE* '12......707 Chamber of Commerce Bldg
Paymaster Henrico Lumber Co Richmond Va
*Johnston, William R Jr .... *CE* '05............28 Yale St Maplewood N J
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Jones, Harold H .... *CE* '10..........96 Norwood Ave Buffalo N Y
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Jones, Henry H .... *CE* '20......................... Durham N C
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Joseph, Louis W .... *CF* '20.................... Warrensburg N Y
Joseph, William B .... *CE* '13.......1201 W Seventh St Wilmington Del
Judson, David H .... *CE* '07............421 Stolp Ave Syracuse N Y
Truscon Steel Co 440 Gurney Bldg
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c/o Ludlow Engrs Winston-Salem N C
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Structural Engineer Aluminum Co of Amer Oliver Bldg Pittsburgh Pa
*Kalberg, S August .... *CE* '10 AMASCE 39 Dwight St New Britain Conn
Kampf, Louis .... *CE* '09............33 Division St Norwich Conn
Textile Engineer Anderson Meyer & Co Tientsin China
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With Hydraulic Steelcraft Co Cleveland O
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Kaufman & Levine Cons & Ind Engrs 21 E 40th St New York City
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Insp & Serv Dept Pate & Robb Ins Brokers 100 Williams St
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Engineer-in-charge Degnon Contracting Co Allaben N Y [N J
Keeler, Louis V .... *CE* '13..........217 Jewett Ave Jersey City N J
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Dist Sales Manager H H Robertson Co 170 Broadway
Kehler, Sherman I... *CE* '94 *MCE* '03 MAS Mar Drftn 1800 Oakley St Baltimore
Civil Engineer [Md
Kehoe, Harry .... *CE* '08............ 161 E Third St Oswego N Y
City Engineer

Kehrhahn, Charles J ....*CE* '09 ......MAAE MCIES 13600 Fourth Ave
Asst Engr Dept Grade Crossing Elim N Y C & St L R R [Cleveland O
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Dean College of Applied Science Univ of Hawaii
Kelley, Charles L ....*CE* '85................Main St Savannah N Y
Civil Engineer
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Junior Engineer N Y State Barge Canal
*Kelley, William D..........*BS MCE* '81......MASCE Long Island City N Y
Pres Kelly & Kelley Engrs Bldrs & Contrs also with Kelly-Demarest Constr Co
[Cleveland O
Kellogg, George D ....*CE* '07......................Greenwood N Y
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Kelly, Edward J Jr ....*CE* '12..............61 W Erie Ave Corning N Y
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Vice-Pres Realty Associates
Kelsey, Sidney E ....*CE* '87........1824 Jefferson St Kansas City Mo
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Assistant State Highway Engineer Austin Tex [Tex
*Kennedy, James C ....*CE* '79......................Carson City Nev
Civil & Mining Engineer Box 503 Ferington Nev
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Block Engineer N Y Tel Co 24 Walker St New York City
*Kerby, Russell T ....*CE* '13.......1019 Kenmore Place Brooklyn N Y
Engineer American Tel & Tel Co 195 Broadway New York City
Kessler, William ....*CE* '13..........23 Ninth St Woodside N Y
Assistant Engineer U S G S 328 Custom House San Francisco Calif
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Draftsman State of Calif San Francisco Calif
Kidde, Reguar T ....*CE* '13........215 W 101st St New York City
Kiddie, John ....*CE* '04....MAAE MAIM&ME Morenci Ariz
Division Mine Superintendent Arizona Copper Co
Kiep, Henry A Jr ....*CE* '10................R F D 55 Westfield N J
Industrial Finance Dept Robertson Cole Co New York City
Kimber, George F ....*CE* '12.......570 Pennsylvania Ave Detroit Mich
Chief Draftsman Pere Marquette R R
*King, Alvin W ....*CE* '07........108 E Moreland Ave Chestnut Hill
Sales Manager Nelson Valve Co Philadelphia Pa
King, Clifford M ....*AB CE* '04 AMASCE MOES MASE Masonic Temple
Senior Asst Engr Div Engrg City of Cleveland O [Sandusky O
*King, Everett E......*AB CE MCE* '11......AMASCE MAREA Urbana Ill
Professor Railway Civil Engineering University of Illinois
*King, Leon T ....*CE* '10 ....20 James St Ilion N Y
Junior Engineer N Y State Barge Canal Herkimer N Y
King, Paul ....*CE* '16..........................Emporia Va
Engineer & Surveyor Atlantic Coast Realty Co Petersburg Va
King, Tao ....*CE* '12 AMASCE 33 Tou Fa Hutang West City
Tai Ping Hutang Inside Tung Chan Hutang Peking China
Kingsland, Lawrence D II ....*CE* '17...............Hotel Beers St Louis Mo
Kinnear, Eugene C ....*CE* '07...1882 Columbia Rd Washington D C
Senior Structural Engineer ICC Bur Val San Francisco Calif

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Marble Export Florence Italy
Knapp, Frank H ....*CE* '11...............AMASCE Blasdell N Y
225 Park St Bridgeport Conn
Kneeland, Herbert D..........*CE* '10.... ....MESWPa 5879 Darlington Road
Prod Mgr United Engrg & Foundry Co 2311 Farmers Bank Bldg Pittsburgh Pa
Knighton, John A.. ....*CE* '91 ..MASCE 207 W 107th St New York City
Div Engr (Harlem River Div) Dept Pl & Str 2221 Madison Ave
Knoch, Julius J ....*MS CE* '92..AMASCE 1717 Gains St Little Rock Ark
Carter & Knoch Consulting Engineers 803–807 A O U W Bldg
Knowlton, G. E ....*CE* '20......240 Goodwin Ave E Orange N J
Knowlton, Robert H ....*CE* '06 MNELA MAIEE 211 Cornell Ave Swarthmore Pa
Power Engr United Gas Improvement Co Philadelphia Pa
Koester, Edwin F ....*CE* '13..AMASCE 811 West St Wilmington Del
Engineer in Charge Surveying Department
Kohn, Arthur H ....*CE* '06.............21 No Lime St Lancaster Pa
Kolberk, Andrew ....*CE* '12............303 E 161st St New York City
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Koo, Nee Sun ....*MCE* '19........MESCh Nai Wai Shanghai China
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Korff, Harry O ....*CE* '16......1720 W Lafayette Ave Baltimore Md
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Engineer Bldg Dept General Electric Co
Kraft, George L ....*CE* '15......1730 First St N W Washington D C
Captain Infantry U S A c/o Adjutant General of the Army
Kramer, Edwin W ....*CE* '06......1801 So Fifth St Missoula Mont
District Hyrdo-Elect Engr U S Forest Service 508 Montana Bldg
Kratzenstein, Hugo........*AB CE* '04..........7 E 94th St New York City
Civil Engineer 152 W 88th St
Krause, Alois W ....*CE* '12.........152 Crafts St Newtonville Mass
Secy Geo E Warren Co 35 Congress St Boston Mass
Krauss, John S ....*CE* '17......974 St Nicholas Ave New York City
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Secy Supertone Talking Machine Co 18 W Twentieth St
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Hyd Engr Lamer Johnson Valve & Engrg Co. Philadelphia Pa
*Krusi, Herman ....*CE* '82.........2033 Central Ave Alameda Calif
Retired
Kuck, John F R...........*BS CE* '12...MAAE 22 W Harris St Savannah Ga
Assistant Engineer Central of Ga Ry
Kurcias, Max . ...*CE* '18............63 E 177th St New York City
Civil & Refrig Engineer U R D Green 154 Nassau St
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With J G White Engrs Corp 43 Exchange Pl

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Structural Engineer Schenck & Williams Dayton Ohio
LaBreque, Henry F ....*CE* '07 ....126 Winthrop St Brooklyn N Y
*Lacazette, Alfred A............*CE* '13....ASME MCuSE Vedado Havana Cuba
Lubricating Engineer Calle 2 entre 9 y 11
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Lahr, Charles ....*CE* '15..........51 Chicago St Elmhurst Mass
Junior Engineer N Y State Pub Ser Comm 1st Dist New York City
Lallou, George E S ....*CE* '20..........1925 Spruce St Philadelphia Pa
Keim Supply Co 1227 Market St
Lanahan, Howard G ....*CE* '09........................Tacoma Wash
Manager Hurley Mason Co 500 Equitable Bldg
Lance, John H ....*CE* '96...MASCE 426 Rutter Ave Kingston Pa
Consulting Engineer 616 2d Nat Bank Bldg Wilkes-Barre Pa
Lance, William L ....*CE* '08............462 Rutter Ave Kingston Pa
With J H Lance Consulting Engineer Wilkes-Barre Pa
Landa, Francisco ....*CE* '07............MCuSE Paseo 194 Vedado
Engineer Inspector Hav Elec Ry Light & Pow Co Havana Cuba
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Lara, Edward M ....*CE* '03.............................Bend Ore
Cashier First National Bank
*Larned, William H ....*CE* '84..........................Haigler Neb
Cashier State Bank of Haigler
Lathrop, John P P ....*CE* '92.................... MEClPh Wayne Pa
Civil Engineer and Contractor Overbrook Pa
Latting, Benjamin F ....*CE* '94........Care C H Latting Shortsville N Y
Assistant to Chief Engineer Indiana Bridge Co Muncie Ind
Lau, Waau W ....*AB* '14 *CE* '15.........................Tientsin China
Assistant Engineer River Improvement Comm
*Lavine, I William ....*CE* '15.......................
Lawrence, Frank E ....*CE* '06....AMASCE 415 W 36th St Savannah Ga
President Lawrence Construction Co Augusta Ga
Lawrence, Theodore F ....*CE* '88........................Chester N Y
Cheese Manufacturer
Lawson, David T ....*CE* '73.......................
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Retired
Lazo, Antonio ....*CE* '07..........108 E 82d St New York City
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Ledger, William H ......*BE MCE* '95 ....MICE Railway Crescent Barcroft
Metropolitan Railway Construction Sydney N S W

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Lee, Haw-Shen .... *CE* '16 .... Yu Yao Chekiang China
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Lee, Kohn Sam .... *CE* '13 .... 14 Helen Terrace Shanghai China
Business

Lee, Teh Tsing .... *CE* '11 *MCE* '12 .... Peking China
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Ludlum Steel Co Watervliet N Y

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Engr with J H Ladew Co Tanners Newark N J

Levine, Samuel .... *CE* '11 .... 355 Riverdol Ave Brooklyn N Y

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Dean Civil Engrg Tongshan College Tongshan China
*Lo, Ying.....................*CE* '16 JASCE Hae-Don-Hon St Nan Chang China
Lockerby, Robert A...........*CE* '06........87 St Matthew St Montreal Can
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Loh, Yuen Chang.............*CE* '14....North Chekiang Road Shanghai China
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Long, Guy E ....*CE* '02...........226 Reynolds St Kingston Pa
Civil Engineer
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Assistant Engineer U S Reclamation Service 605 Tramway Bldg
Loomis, Arthur B........*BS MCE* '94............................ Toledo O
Chief Engineer Structural Dept Toledo Bridge Crane Co
Loomis, Van Wyck W ....*CE* '14............................
*Loomis, Willis H ....*CE* '94......28 Rock Island St Gouverneur N Y
President Mining Co
Lopez, Carlos ....*CE* '09......................Iloilo Iloilo P I
Surveyor 34 Yznart St
Lord, Charles H ....*CE* '11..MAWWA 1 Mechanic St Ogdensburg N Y
Superintendent City Water Works
Lord, George W ....*CE* '20......1550 Ashland Ave Evanston Ill
Lordly, Henry R ....*CE* '93 *MCE* '20 MEIC 74 Strathearn Ave West Mon-
Grad Student Coll of C E C U Ithaca N Y [treal Can
*Lott, Henry D ....*CE* '15..............370 E 23d St Brooklyn N Y
Love, Albert J ....*CE* '09..........92 Downer Place Aurora Ill
Vice President Love Brothers Inc
*Loveland, Chester H ....*CE* '10..........2606 Durant Ave Berkeley Calif
Hyd Engr State R R Comm 953 Flood Bldg San Francisco Calif
*Lovell, Earl B ....*CE* '91..AMASCE 160 Broadway New York City
Prof Civ Engrg Col Univ Mgr & Chf Engr E & S Dept Lawyers Title & Tr Co
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*Sloane, George G .... _CE_ '12 .... 1733 T St N W Washington D C
*Sloat, John A .... _CE_ '08 .... Clyde N Y
Sloat & Sloat Autos & Farm Machinery
*Smallman, Ralph A ...... _CE_ '08 _MCE_ '09 .... AMASCE Wauseon O
Vice-Pres & Treas Smallman Brice Constr Co Inc Birmingham Ala
Smith, Alger J .... _CE_ '20 .... Reynolds Ave Corning N Y
Smith, Arthur L .... _CE_ '11 .... Selma Ala
Division Engineer State Highway Dept
Smith, Benjamin L .... _CE_ '14 ...... AMASCE MECB 616 Munsey Bldg
Designing Engineer Norton Bird & Whitman Newark N J [Baltimore Md
*Smith, Charles E .... _CE_ '13 .... Lock Box 18 Manchester N Y
Smith, Dietz A .... _CE_ '13 .... 313 E King St York Pa
Hydraulic Engineer S Morgan Smith Co
Smith, Eugene L .... _CE_ '12 .... 444 Marine Bank Bldg Buffalo N Y
Smith, Eugene R .... _CE_ '77 .... MASCE Islip N Y
Civil Engineer & President First National Bank
Smith, George G .... _CE_ '98 _MCE_ '99 .... Algerine St Stanley N Y
Farmer
Smith, Harry C .... _CE_ '07 ...... 150 Greenwood St Canisteo N Y
Senior Assistant Engineer Clary Block Seneca Falls N Y
Smith, Henry E .... _CE_ '06 .... Baltimore Md
Vice-President H Smith & Sons Co Contractors & Builders
Smith, John W .... _B Arch CE_ '12 .... 1500 Park Ave Baltimore Md
With Norton Bird & Whitman 616 Munsey Bldg
Smith, Joseph E .... _CE_ '20 .... 818 Cleveland St Durham N C
Smith, Lawrence R .... _CE_ '07 ...... 350 Tremont St No Tonawanda N Y
Manager Wholesale Dept Ray H Bennett Lumber Co

Smith, Leonard J ....*CE* '92..........MEClPh 2430 Fairmount Ave
Division Engineer Phila Rapid Transit Co Philadelphia Pa

*Smith, Marion deK Jr......*AB CE* '01..AMASCE 6 Wash Ave Chestertown Md

*Smith, Miller A ....*CE* '81..MASCE 235 Lincoln Rd Brooklyn N Y
Cons Engr Smith Ames & Chisholm 508 Lonja Bldg Havana Cuba

*Smith, Stephen H.............*CE* '13......................Sherburne N Y
Hydraulic Engineer Milton N H

*Smith, Theodore L ....*CE* '16............49 Meyers St Forty Fort Pa

*Smith, William C ....*CE* '85...............................MASCE

Sneckenberger, Earl M....*Ph B CE* '05..................MAAE Billings Mont
City Engineer City Hall

*Snider, Clarence A ....*CE* '91......Beechmont Park New Rochelle N Y
Secy & Treas The Union Sulphur Co 17 Battery Place New York City

*Snively, William J ....*CE* '16.............................Chicago Ill
Cost Engineer 645 No Michigan Ave

Snow, Arch M ....*CE* '06.................44 Elm St Malone N Y
Engineer Court House

*Snyder, Charles H ....*CE* '02..AMASCE 170 W Fourth St Oswego N Y
Assistant City Engineer City Hall

*Snyder, Howard H ....*CE* '13......725 E Twelfth St Brooklyn N Y
Asst Engr and Supt of Cons R Carvel Co Inc 531 E 138th St N Y C

*Sobel, Julius ....*CE* '16....MAAE 135 Vernon Ave Brooklyn N Y
Draftsman New York Central R R

*Soman, Philip E ....*CE* '17..........34 W 112th St New York City

Sorokin, Marcus ....*CE* '20....69 Kosanski Kostoff-on-Don Russia

*Sourwine, James A............*CE* '12..AMASCE 426 G St San Bernardino Calif
c/o Bureau Public Roads Washington D C

Souza, Antonio C P ....*CE* '14........Rua Helvetia 31 Sao Paulo Brazil
Railway Engineer

*Spalding, Lawrence ....*CE* '13......MARB&BA Box 243 Greenville Pa
Supervisor Structures Besemer & Lake Erie R R

*Spamer, Morris A.............*CE* '13......929½ Oak Hill Ave Hagerstown Md
Manager Joseph Brenner & Co Barksdale Wis

Spandau, Harry M......*CE* '09 *MCE* '10 MSPEE FAAAS 813 DeKalb Ave
Assistant Ind Engr 55 Liberty St New York City [Brooklyn N Y

*Sparfield, Emi H ....*CE* '12........ 175 St James Pkace Buffalo N Y
Assistant Production Manager American Chain Co Bridgeport Conn

*Spear, George P Jr ....*CE* '16............242 Gregory Ave Passaic N J
Engineer Dept N Y Tel Co 203 Broadway New York City

*Specht, Harry G ....*CE* '13..........335 E 68th St New York City
Industrial Engineer C E Knœppel & Co Inc 52 Vanderbilt Ave

*Spelman, Harold J ....*CE* '10............AMASCE Huntington W Va
Division Engineer State Road Comm 107 Robson Prichard Bldg

Spelman, William A...........*CE* '08.........................Champlain N Y

*Spence, Thomas R ....*CE* '17.........................College Sta Tex
Supt Surplus Federal Equipment State Highway Dept Austin Tex

Spencer, Clifton B ....*CE* '94.....2914 Linwood Blvd Kansas City Mo
Valuation Engineer St Louis-San Francisco Ry St Louis Mo

*Speyer, Elwin G ....*CE* '07......MASCE 1509 Seneca St Buffalo N Y
Assistant Engineer Dept State Engineer Pier No 1 Erie Basin

*Spiker, William C.............*CE* '00......MASCE MAAAS 33 E Fourth St
Consulting Engineer 1121 Candler Bldg Atlanta Ga

Spivak, William ....*CE* '20........194 Thatford Ave Brooklyn N Y
*Spivey, Willis T ......*BS in CE CE* '10..............AMASCE Greenville Ga
Material Handling Engineer W T Spivey & Co Philadelphia Pa
*Spragins, William E ....*CE* '08......... Univ Club Salt Lake City Utah
Wholesale Stove & Range Business 702 Walker Bank Bldg
Sprague, Danly D ....*CE* '95 MAAE 131 Balboa St San Francisco Calif
Structural Engineer Val Dept I C C Wells Fargo Bldg
*Sprague, Frank D ....*CE* '11.......15 Greenway Terr Forest Hills N Y
*Sprigg, C Crawford ....*CE* '07 15 Central Ave St George Staten Isd N Y
President General Contrg & Engrg Co 29 Broadway New York City
*Squire, Walter L ....*CE* '11..........2902 Main St Niagara Falls N Y
Manager Purchase & Order Dept U S Light & Heat Corp
*Stahl, John J.. ....*CE* '12..........315 Manning Blvd Albany N Y
Highway Engineer Bur Pub Roads 301 Custom House Bldg Denver Volo
Stalfort, J Alfred ....*CE* '10...AMASCE MEClB 3217 Carlisle Ave
General Mgr Bldg Dept Consol Engrg Co 243–59 Calvert Bldg Baltimore Md
Gen Mgr Bldg Dept Consol Engrg Co 243–59 Calvert Bldg Baltimore Md
Stalker, John H ....*CE* '20................9 James St Montclair N J
*Standiford, Harry R ....*CE* '10 ......AMASCE 1229 L St N W Wash D C
Constr Supvr J G White Engrg Corp 43 Exchange Pl New York City
Stanton, Grove A ....*CE* '07......MPNWSE R F D 9 Auburn N Y
*Stanton, Robert B Jr...........*CE* '09...........71 Broadway New York City
Manager Foreign Sales Dept U S Cl Pipe & Foundry Co
*Stapley, Edward R ....*CE* '14................32 Oak St Geneseo N Y
Secretary Geneseo Auto Co
*Starkweather, Alfred K ....*CE* '12 AMASCE 65 Grand View Ave Plainfield
Engineer New York Telephone Co 15 Dey St New York City [N J
Starr, Charles F ....*CE* '15....MRoES 64 Rowley St Rochester N Y
Structural Engineer Genesee Bridge Co Inc 666 Plymouth Ave
*Stearns, Fred L...............*CE* '10.................AMASCE Norwich Conn
With American Bridge Co Wilkins Bldg Washington D C
Stearns, John ....*CE* '06...AMASCE 446 Ocean Ave Brooklyn N Y
Constr Supvr J G White Engrg Corp 43 Exchange Pl New York City
Stebbins, Smith H ....*CE* '95............590 E 19th St Brooklyn N Y
Assistant Chief Map Division Hall of Records
Steel, Ernest W ....*CE* '20...................... Maple Shade N J
*Steele, Gilbert V ....*CE* '10............245 State St Flushing N Y
Corrugated Bar Co 17 Battery Place New York City
*Stegner, Cliff M...........*BS CE* '00....MASCE MAIArch 3455 Cornell Place
Stegner & Hughes Archs & Engrs 1012 Com Trib Bldg Cincinnati O
*Stein, Myer ....*CE* '17.............. 508 Elton St Brooklyn N Y
*Steinacher, Gustavo J ....*CE* '92...214 Cathedral Parkway New York City
Care Arturo Rodriguez Box 142 San Juan P R
*Steljes, Martin ....*CE* '15........ 1419 Clinton Ave New York City
*Sterling, Guy.................*CE* '87............MASCE 1579 E Ninth So St
Consulting Engineer 1115 Newhouse Bldg, Salt Lake City Utah
Stevens, Harold B ....*CE* '02...............Masontown Fayette Co Pa
Field Engineer Carnegie Steel Co Clairton Pa
Stevens, John H ....*CE* '08.........................Rome N Y
Village Engineer Massena N Y
*Stevenson, Albert L ....*CE* '13............4910 Arch St Philadelphia Pa
With Seelye & Fraser Cons Engrs 101 Park Ave New York City

Stewart, Charles G......*BS CE* '12..................MAAE Box 612 Flora Ill
Assistant Division Engineer Ill Div B & O R R
Stewart, Clinton B............*CE* '90.....AMASCE MWeSE 1709 Adams St
Consulting Hydraulic Engineer 309 Wisconsin Bldg Madison Wis
*Stewart, David B Jr ....*CE* '09.......2301 No Charles St Baltimore Md
Stewart, Walter P ....*CE* '07..........1212 E Ash St Portland Ore
c/o Alexander Hamilton Inst 13 Astor Pl New York City
Stibolt, Victor A..............*CE* '11..........532 W Seventh St Davenport Ia
Natalbany Lumber Co Ltd Hammond La
*Stidham, Harrison ....*CE* '91...AMASCE MWaSE 3322 Newark St
Wilkins Bldg Washington D C
Stine, Charles R ....*CE* '96..........................
Stirling, Vincent R............*CE* '05............c/o H P Short Oroville Calif
Stockdale, Thomas R ....*CE* '07..........................Summit Miss
Civil Engineer with Gardner & Howe 76 Porter Bldg Memphis Tenn
Stolz, Albert F ....*CE* '19....500 Wilmac Bldg Minneapolis Minn
c/o Merchants Life & Casualty Co
Stone, Don O ....*CE* '09........2400 Indiana Ave Columbus O
Maintenance Engineer State Highway Dept
*Stone, Edward C ....*CE* '02.........Route 2 Box 30 Gardena Calif
Brokers Agent
Stone, George C ....*CE* '11................AMASCE Altavista Va
Engineer Lockwood, Greene & Co of Boston Mass
Stone, James S ....*CE* '89..............516 Grimes St Sewickly Pa
Checker American Bridge Co Ambridge Pa
Checker with Amer Bridge Co
*Stone, Morris ....*CE* '15..........38 Lincoln Ave Amsterdam N Y
Stone's Toggery Shops
Storey, Frank S ....*CE* '02............................ AMASCE
c/o The Phoenix Constr Co 41 Park Row New York City
Storey, William R ....*CE* '81..................MRoES Rochester N Y
Civil Engineer and Surveyor 510 Ellwanger & Barry Bldg
*Storz, Joseph F ....*CE* '06..........35 Wyoming St Wilkes-Barre Pa
Mainetnance of Way Dept Lehigh Valley Railroad
Stott, Charles A ....*CE* '19............3167 17th St Washington D C
With Chas G Stott & Co Inc Paper & Stationery
Strahan, Joseph C J ....*CE* '13.........................
Strang, Percival ....*CE* '97......Colonnade Apts Indianapolis Ind
General Superintendent The Dunn McCarthy Co 520 Old Colony Bldg Chicago
Strasburger, Edgar J ....*CE* '00............303 So Idaho St Butte Mont
Strasburger Civil and Mining Engr Co 614 Daly Bank Bldg
*Stratton, William H...........*CE* '88..........194 Prospect St Ridgewood N J
Mgr Bridge and Bldg Dept U S Steel Products Co 30 Church St N Y C
Strong, Herbert W ....*CE* '94............1939 E 90th St Cleveland O
Secretary The Strong Carlisle & Hammond Co 1392 W Third St
Strumer, Samuel..............*CE* '17..........1384 Bristow St New York City
Fouquor Concrete Co 29 Broadway
Stuart, Thomas M ....*CE* '15........432 Belmont Ave Springfield Mass
Industrial Engineer Tolhurst Machine Works Troy N Y
Stubbs, James H ....*CE* '76.....................Fort Morgan Colo
Civil Engineer

*Sturdevant, James H .... *CE* '05............AMASCE Poughkeepsie N Y
Division Engineer N Y State Highway Commission
*Sullivan, John G.............. *CE* '88 MASCE MEIC MAREA 207 Harvard Ave
Consulting Engineer 703 McIntyre Bldg Winnipeg Manitoba Can
*Sullivan, Philip L .... *CE* '18..........11 Loring Hall Springfield Mass
Maintenance of Way Dept L V R R Buffalo N Y
Summers, Richard E J .... *CE* '14 AMASCE 508 McNair Ave Wilkinsburg Pa
Str Engr H K Ferguson Co 6523 Euclid Ave Cleveland O
*Summers, William F .... *CE* '14...............144 Queen St Ithaca N Y
With Edward Sprigg Contractor & Builder
*Sun, Taoyuh C .... *CE* '09..AMASCE 15 Pekin Rd Shanghai China
Managing Director Chuchow-Chinchow Ry Tur-farr Hutung Peking China
Sun, Yu-fong................. *CE* '18......JASCE 2 Taku St Tientsin China
*Super, Stanley L.............. *CE* '12....MEClPh 2047 W Ontario St Philadel-
Chief Draftsman Renovo Division P R R Erie Pa [phia Pa
*Supplee, George W .... *CE* '15...................Haddon Heights N J
Assistant Engineer P & R R R Port Richmond Philadelphia Pa
Sutton, Paul B .... *CE* '12........818 Academy St Watertown N Y
City Engineer
Swanitz, Henry W .... *CE* '00.............AMASCE 1390 Seventh Ave
Assistant Engineer Board of Public Works San Francisco Calif
*Swerdlove, Louis .... *CE* '17..............MAAE 1384 Prospect Ave
Junior Engineer Room 606 39 Whitehall St New York City
Swick, Charles H .... *CE* '10..........................Livonia N Y
99 Cannon St Poughkeepsie N Y
*Swick, Clarence H .... *CE* '07...................Capitol Heights Md
Geodetic Computer U S C & G S Washington D C
*Swindells, Joseph S .... *CE* '95 *MCE* '98..MASCE 1090 18th St Brooklyn
Consulting Engineer 111 Broadway New York City [N Y
Swinney, Robert E .... *CE* '08...........................Mobile Ala
Field Engineer Chickasaw Shipbuilding Co
*Symonds, George R B .... *CE* '09..............AMASCE Holley N Y
Town Engineer Nutley N J
Tan, Vidal A .... *AB MA* '18 *CE* '18........469 Salsipuedes Manila P I
Civil Engineer and Instructor University of the Philippines
Tate, Robert L H .... *CE* '12....AMASCE 219 Linden Ave Ithaca N Y
Civil Engineer PO Box 218 Paramaribo Dutch Guiana S A
*Taussig, J Wright............. *CE* '08..AMASCE So Dwight Pl Englewood N J
Raymond Concrete Pile Co 140 Cedar St New York City
Tavares, Juan T .... *CE* '18................Santiago Dominican Rep
Engineer Tavares Socs Builders
*Taylor, Albert M .... *CE* '15.........................Ardmore Pa
Taylor, Clinton L............. *CE* '12........................ Wyalusing Pa
Agriculture
*Taylor, Edward H .... *BS CE* '12........Care C & P Tel Co Roanoke Va
Engineer Austin Co Cleveland O
Taylor, Robert C .... *CE* '99............620 Mellon St Pittsburgh Pa
Superintendent Lucy Furnaces Carnegie Steel Co
*Taylor, Roy.................. *CE* '10..........455 Greene Ave Brooklyn N Y
Munson Steamship Co 82 Beaver St New York City
Taylor, Royden J .... *BE CE* '03..........1224 Candler Bldg Atlanta Ga
Civil Engineer 644 Wayne Ave Indiana Pa

*Taylor, S Leroy .... _CE '13_........3605 Park Ave Minneapolis Minn
Highway Engineer U S Bureau Public Roads 224 P O Building

*Taylor, Thomas U........ _CE MCE '95_..............MASCE San Antonia Tex
Dean of Engineering Univ of Texas Austin Tex

*Taylor, T Walter .... _CE '00_......1424 W 35th St Oklahoma City Okla
Assistant General Manager Fortuna Oil Co 424 Lee Bldg

Taylor, William R .... _CE '03_.............1257 Dean St Brooklyn N Y
Thos F Taylor's Sons Inc Coal 588 Kent Ave

Tehan, Joseph J.............. _CE '09_............4 Sheridan St Auburn N Y
Assistant Engineer L V R R Co

Tempest, Richard C D .... _CE '09_......163 Albermarle Ave Rochester N Y

*Ten Hagen, Henry .... _CE '13_..............JASCE High Falls N Y
County Engineer N Y State Hwy Comm Warsaw Wyoming Co N Y

Tenney, Maynard A .... _CE '98_........1049 E 18th St Brooklyn N Y
Inspector Subway Construction Philadelphia Pa

Terrazas, Federico .... _CE '16_........220 Western Blvd El Paso Tex
743 Maple Lane Sewickley Pa

Terrell, Adelphus C .... _CE '00_..........................Macon Mo
Division Engineer on Val N P Ry Seattle Wash

Thacher, Cornelius S .... _CE '78_............MAAAS Clifton Springs N Y
Professor Mathematics Retired

Thatcher, Romeyn Y .... _CE '09_..........1077 Elmwood Ave Buffalo N Y
Civil Engineer Lacakwanna Steel Co Buffalo N Y

Thebaud, John E .... _CE '95_............234 Parker Ave Buffalo N Y
Engineering and Patents 973 Ellicott Square

Thiele, Claude M .... _CE '11_........1472 Kilbourne Pl Washington DC
Captain U S A Coast Artillery Corps Coblenz Germany

*Thomas, Edward J............ _CE '15_......1002 W Lafayette Ave Baltimore Md
Assistant Superintendent DuPont Chemical Co Barksdale Wis

Thomas, Edwin R .... _CE '09_................Box 202 Warren R I
Constructor 801 Bay State Bldg Lawrence Mass

Thomas, Howard .... _CE '77_...........................Stuart Fla
Retired

Thomas, James B............. _CE '04_............122 Columbus St Elyria O
Assistant Vice-President The Garford Mfg Co

Thomas, Joseph A .... _CE '20_ c/oMrs B A Hosfeld Clark's Summit Pa

*Thomas, Seymour P .... _CE '72_ c/o Phoenix Iron Co 49 William St New
Retired [York City

Thomas, William C .... _CE '01_..........210 Plummer Ave Emsworth Pa
Checker

*Thomassen, Victor G .... _CE '11_..............AMASCE Great Kills N Y
Res Engr US Steel Products Co 11 Rue Edourd VII Paris France

Thompson, Alexander M ...... _CE '13_..405 Plymouth Bldg Minneapolis Minn

*Thompson, Chester A .... _CE '16_.............158 Dana Ave Albany N Y
G & J Tire Co Indianapolis Ind

*Thompson, Ellis D .... _CE '76_ MASCE 210 So 42d St Philadelphia Pa
Engineer for Dredging Emer Fleet Corp Washington D C

Thompson, Elmer E .... _CE '11_............629 W Water St Elmira N Y
Dratfsman American Bridge Co

Thompson, Ewing .... _CE '14_.............305 Third Ave Lewiston Ida

*Thompson, George R......... _CE '17_..............41 Woolsey St Astoria N Y

*Thompson, Ho ie H .....*BS CE* '05............758 Franklin St Denver Colo
President Thompson Bros Lumber Co Trinity Tex
Thompson, Karl F ....*CE* '14....................Seneca Falls N Y
Asst Engr N Y State Highway Comm 121 Seneca St Hornell N Y
Thompson, Alexander Jr.......*CE* '99....... MASCE 104 No 22d St Orange N J
Chief Engineer Concrete Steel Co 42 Broadway New York City
Throop, Henry G ....*CE* '05..........AMASCE 2117 So Geddes St
Contractor Syracuse N Y
Throop, William B............*CE* '77..........464 No Prairie St Galesburg Ill
General Superintendent Q O & K C and I & St L R Rs
*Thweatt, Hardin H ....*CE* '13..............2020 E 90th St Cleveland O
Assistant Superintendent Van Dorn & Dutton Co
Tier, Lewis P ....*CE* '74......10515 Bryant Ave N E Cleveland O
Car Dept N Y C R R Co Collingwood O
*Tiffany, Nathan N ....*CE* '05........AMASCE East Hampton N Y
Civil Engr & Sur Ch Board of Supervisors Suffolk Co Cashier Osborne Bk
*Tiffany, Nelson O Jr ....*CE* '01..............214 W Ferry St Buffalo N Y
President & General Manager Masonic Life Assoc Masonic Temple
*Tillottson, Edwin H.............*CE* '17........100 Chandler St Detroit Mich
Tilton, Benjamin E ....*CE* '97 MASCE MAREA 18 Mason Pl Utica N Y
General Manager N Y State Rys 303 Gridley Bldg Syracuse N Y
Ting, Zung-Kun ....*MCE* '20 ......MSSCh Kun-Shan Kiang-Su China
Todd, Clarence L ....*CE* '07 AMASCE MWPaSCE 1111 Harvard St N W
Contrg Engr Mgr Wash Off Des Moines Steel Co Munsey Bldg Wash D C
Tolles, Frank C ....*CE* '05 AMASCE 265 So Columbus Ave Mt Vernon
General Superintendent Bur of San Dept of Pub Serv Akron O [N Y
Tomlinson, Frank C ....*CE* '74............721 Park Ave Ironton O
c o A G Simpson 800 Citizen's Nat Bank Bldg Los Angeles Calif
Tompkins, George S ....*CE* '96 AMNFPA 47 So Manning Blvd Albany
Superintendent Firemen's Fund Ins Co 40 Kilby St Boston Mass [N Y
*Tompkins, Howard C ....*CE* '03..........819 Roland Ave Baltimore Md
Member of Firm R K Meade Co 13 E Fayette St
*Toms, Raymond E............*CE* '07.........................Frederick Md
Senior Highway Engineer US Dept Agriculture Chicago Ill
*Torrance, Chester C ....*CE* '99 *MCE* '00...MCuSE Industria 100 Havana Cuba
Torrance & Portal Engineering Contractors
Torrance, Robert S ....*CE* '16.......165 Buckingham Road Yonkers N Y
Carson Construction Co Savannah Ga
*Torrance, William M ....*CE* '95......MASCE P O Box 180 Savannah Ga
Vice-President & Chief Engineer Carson Construction Co
*Towl, Forrest M ....*CE* '86 MASCE MASME MAIME Shelter Is Hts
President Southern Group Pipe Lines 18 Broadway New York City [N Y
*Towle, John W ....*CE* '94..........MOmTecCl 3602 Pacific St
President Omaha Steel Works 348 Bee Bldg Omaha Neb
Townsend, David W ....*CE* '15..............25 Judd St Honolulu T H
*Trask, Clarence H ....*CE* '12....................R D 2 Fulton N Y
Pontiac Mich
Trautwine, John C 3d ....*CE* '00....MECIPh 1110 So 46th St Phila Pa
Civil Engr & Assoc Ed Trautwine Civ Engrs Pocketbook 257 So Fourth St
*Trimpi, Allen L ....*CE* '10..AMASCE 35 Stockton Pl E Orange N J
Assistant Coach E Orange Athletics

*Tripp, Harry H ....CE '08..........................Dryden N Y
Resident Engineer C P R R Edmonton Alberta Canada
*Troxell, Willard W ....CE '14 . MEClB 3312 W North Ave Baltimore Md
*Truesdell, Walter E...........CE '97 MConnSCE 29 Mountain Ave Summit N J
Industrial Engineer 5 Beekman St New York City
Trumbull, William C ....CE '82................11½ Gruff St Oil City Pa
Assistant City Engineer
*Truran, Ernest A ....CE '95........33 Lincoln Terrace Yonkers N Y
Assistant Engineer Turner Constr Co 244 Madison Ave New York City
*Tsai, Ping Y ....CE '11 AMASCE Chang Chow Kiang Su China
Assistant Engineer Chuchow-Chinchow RR Peking China
*Tuller, Jesse D ....CE '09..........88 Branch Ave Red Bank N J
Superintendent of Construction
Tunnicliffe, John C ....CE '17......MWeSCE R F D 369 Moline Ill
Hydraulic Engineer 801 Putnam Bldg Davenport Ia
*Turneaure, Frederick E........CE '89..........MASCE MWeSE Madison Wis
Dean College of Engineering University of Wisconsin Consulting Engineer
Turner, Ebenezer T ....CE '83...................Box 434 Ithaca N Y
Vice President First National Bank & Morse Chain Co
Turner, Horace G ....CE '92......................Pope's Mills N Y
Rossie N Y
Turner, Myron W ....CE '11...................MAAE Atlantic Ia
Mech Supt Gun Cotton Plant Canadian Explosives Ltd Noble Ont Can
Turner, William J ....CE '07.................MAIME Lexington Va
Assistant Manager Braden Copper Co Rancagua Chile S A
Turrill, Sherman M ......BA CE '01 ....
*Tuttle, Sidney L ....CE '01...................R D 1 Corning N Y
Field Manager Hyres Cond Milk Co 316 Mill St Ithaca
Tuttle, Walter I ....CE '02...MASCE 32 Medway St Providence R I
Treasurer & General Manager Frank Mossberg Co Attleboro Mass
*Twining, William ....CE '90......411 Center St E Mauch Chunk Pa
Engineer Maintenance of Way C R R Co of N J
*Ullrich, Carl O.. ....CE '08......MAISCE 6 Federal St Albany N Y
Asst Deputy Commr Bur Spec Franchises State Tax Dept Capitol Bldg
*Underhill, Arthur ....CE '99..........MASLArch Wallingford Conn
Landscape Architect
Underhill, George G ....CE '06... AMASCE 23 Western Ave Albany N Y
Construction Engineer Fraser Brace & Co Power Bldg Montreal Can
Constr Engineer Fraser Brace & Co Power Bldg Montreal Can
Underwood, Howard W ....CE '01..................AMSACE Moglan Pa
Genl Mgr Engr & Contr Field Barker and Underwood Philadelphia Pa
*Underwood, Paul H ....CE '07............106 Catherine St Ithaca N Y
Assistant Professor Topographic & Geodetic Engrg Cornell University
*Unger, George F ....CE '10.......... 31 Berkeley Place Buffalo N Y
Civil Engineer 328 Prudential Bldg
*Upjohn, Richard R ....CE '80 BD.............Garrison-on-Hudson N Y
Priest 1840 81st St Brooklyn N Y
Urner, Jonas P ....CE '05.........................Frederick Md
Scott & Hume Contrs Zarale c/o Fregorifico Hall Buenos Aires Arg Rep S A
Urquhart, Leonard C ....CE '09. AMASCE Oak Hill Road Ithaca N Y
Assistant Professor of Bridge Engineering Cornell University

Utz, Charles P .... *CE* '04........90 Richland St Rochester N Y
Vice President Alexander Shumway & Utz Co 16 State St
Valderrama, Manuel A....... *CE* '18 131 Bay 10th St Bath Beach Brooklyn N Y
c/o Tavares Socs Santiago Dominican Rep
Van Camp, Paul M .... *CE* '20....................... Fine View N Y
*Van Campen, James K .... *CE* '17..........145 So Clinton St Olean N Y
Dist Sales Mgr Camden Forge Co 984 Union Arcade Bldg Pittsburgh Pa
Van De Mark, Otis S .... *CE* '10..............410 Gulf Bldg Houston Tex
Vice President American Construction Co
*Vanderbeek, Horace A. *CE* '11 *MCE* '12 .....MSPEE MESChina Somerville N J
Concrete Engineer Concrete Steel Co 42 Broadway New York City
*Vandevanter, Elliott .... *CE* '08..................AMASCE Leesburg Va
Superintendent Whiting Turner Concrete Co Baltimore Md
Vanneman, Arthur V.......... *CE* '09...........................Tyrone Pa
President & General Manager Tyrone Lime & Stone Co
Vanneman, Charles R .... *CE* '03 AMAREA 555 Providence St Albany N Y
Chief Div Steam Railroads N Y State Public Service Comm 2d Dist
*Van Sicilen, Abram L .... *CE* '12.....298 St Anns Ave Richmond Hill N Y
Draftsman N Y State Public Service Comm 7th Div New York City
Van Valkenburg, Paul I .... *CE* '20....8509 107th St Richmond Hill N Y
*Van Vliet, Paul D .... *CE* '10 AMWeSE 160 Forest Ave Oak Park Ill
Publicity Mgr Universal Port Cem Co 208 So La Salle St Chicago Ill
Vedder, Herman K .... *CE* '87.......................E Lansing Mich
Professor Civil Engineering Mich Agr Coll
Vedder, Wellington R .... *CE* '91..........................Catskill N Y
Vickers, Thomas McE.... *CE* '90 *MCE* '91..........313 Maple St Syracuse N Y
Secretary & Treasurer Syracuse Dry Goods Co 200 So Clinton St
*Viertels, Ephriam .... *BS CE* '05......776 Prospect Ave New York City
Engineering 1 Beeckman St
*Vieweg, Fred Jr .... *CE* '11 ..c/o Cornell Club 30 W 44th St New York
c/o Amer Trona Corp Trona Calif [City
*Vieweg, Otto C .... *CE* '16............ 161 DeWitt Ave Elmira N Y
Statistician Elmira Water Light & R R Co
Vincent, Everett M .... *CE* '15............. 40 Park Place Goshen N Y
Reinforced Concrete Designer Chile Exploration Co 120 Broadway N Y C
Vivoni, Armando .... *CE* '15...................... San German P R
Assistant Superintendent Construction Romana Dominican Rep
*Vizcaino, José M .... *CE* '15.............Vives 247 Cardenas Cuba
Contracting Engineer
*Vogelson, John A .... *CE* '00 MASCE 8009 Crefeldt St Philadelphia Pa
Chief Bureau of Health 708a City Hall
*Volz, Charles A............... *CE* '11.........................
Public Service Comm Albany N Y
Vosburgh, Claude G .... *CE* '09..............33 Albion St Malden Mass
Vose, Walter I .... *CE* '92..........................Manville R I
Merchant
*Wadsworth, Joel E............ *CE* '90.....MASCE MAREA MASTM MAI&SI
Division Engineer American Bridge Co 30 Church St New York City
*Waesche, George E........ *AB CE* '95............14 Summit St Glen Ridge N J
Consulting Engineer with Sanderson & Porter 52 William St New York City
Wagner, George O .... *CE* '00........210 W 90th St New York City
Vice-President Terry & Tench Co Inc Grand Central Term

*Wait, Bertrand H..............*CE* '02 MASCE 62 Montgomery St Poughkeepsie
Dist Engr Port Cem Assoc Chg N Y Off 347 Madison Ave New York City [N Y

*Wait, John C ....*CE* '82 *MCE* '91 *LLB* MASCE M Mun Soc E 1520 Jessup Ave
Attorney at Law 233 Broadway [Highbridge N Y C

*Wait, Owen A ....*CE* '98............AMASCE 1629 West 47th St
Edison Building Los Angeles Calif

*Wait, Robert S ....*CE* '13 MMunSNY 187 No Broad St Norwich N Y
Engineer and Contractor

*Walbran, Nicholas A ....*CE* '18........................Oriskany N Y

Waldo, Reginald..............*CE* '19....................Campbell Hall N Y
Junior Assistant Engineer N Y State Highway Dept Syracuse N Y

Wales, William H Jr ....*CE* '12..................R F D 4 Oswego N Y

Walker, Carl H................*CE* '18..........Cathedral Apts Baltimore Md
President Walker Equipment & Supply Co

Walker, Charles L ....*CE* '04......AMASCE 218 Univ Ave Ithaca N Y
Assistant Professor Sanitary Engineering Cornell University

Wall, James J Jr ....*CE* '16...........1212 East First St Duluth Min

Wallace, Aaron V D ....*CE* '20.........................Goshen N Y

Wallhauser, George O ....*CE* '96..........602½ E State St Olean N Y

*Walzer, Isidore ....*CE* '09.......................Hempstead N Y
County Assistant Engineer N Y State Highway Comm Mineola N Y

*Walzer, Samuel J ....*CE* '12......881A Lafayette Ave Brooklyn N Y
President Walzer Bros Corp 44 Court St

Wang, Chieh-Yao...........*MCE* '19..MChES 3 Tah-Sen Bridge Ningpo China

Wang, Chien Hsien ....*MCE* '20......Hopei Kwanshan St Tientsin China

Wang, Tsan.............*CE MCE* '12........................*Tientsin China*

Wanzer, Charles T ....*CE* '13........403 Elmwood Ave Ithaca N Y
Assistant Resident Engineer Wateree Power Co Lugoff S C

*Ward, Albert A...............*CE* '13..........32 South St Stamford Conn
Real Estate Ithaca N Y

Warner, Howard S ....*BS CE* '11........921 Crawford St Vicksburg Miss
Oil Business

Warner, Loring K ....*CE* '10............336 E Church St Marion O
President Marion Sand & Gravel Co

Warner, Monroe ....*CE* '88 ....MClES MOTA 1752 E 89th St
Manager Warner Mfg Co 810 Citizens Bldg Cleveland Ohio

*Warriner, Thomas R ....*CE* '93 MIaES 1011 Third Ave E Cedar Rapids Ia
Consulting Civil Engineer 324 Downs Bldg

*Warthorst, Frank W ....*CE* '74 MA AAS R D No2 Box32 Bakersfield Calif
Retired Manufacturer

*Washburn, Frank S ....*CE* '83....MASCE Grace Church St Rye N Y
President American Cynamid Co 511 Fifth Ave New York City

Wasson, Charles W ....*CE* '74.......................Friendship N Y
Manufacturer Cuba N Y

Watkins, Charles B ....*CE* '15 .MEClB 1105 N Gilmor St Baltimore Md
Lt(jg) CEC Public Works Dept Naval Operating Base Norfolk Va

Watson, Carl H ....*CE* '10..............AMASCE Great Neck N Y
President Gregory Coal & Lumber Co

Watson, Ross ....*CE* '12...........................Danville Va
Secy-Treas & Gen Mgr Watson-Fitzgerald Co Inc Builders Supplies

Weatherlow, Hugh E..........*CE* '07.............326 So Union St Olean N Y
Off Mgr of Constr Raymond Conc Pile Co 140 Cedar St New York City
Weatherson, John ....*CE* '95 *MD* MAMA Grand Boulevard Chicago Ill
Associate Professor Medicine Univ of Ill
Weaver, David W ....*CE* '13................17 King St Jamaica N Y
Rodman Classified Service Penn R R Co Philadelphia Pa
*Webb, James R ....*CE* '11..........25 Prospect St Cortland N Y
With Todd & Robertson Contractors New York City
Webb, Seth W ....*CE* '06......MAAE 4146 E 106th St Cleveland O
Assistant Engineer 54 New York Central Bldg
*Webb, Walter L....*CE* '84 *MCE* '89 ....MASCE MECIPh MAREA
31 Runnymede Ave Lansdowne Pa
*Weber, Bernis B ....*CE* '04 MAAE MESWPa 111 Cowell Ave Oil City
City Engineer City Hall [Pa
Weber, Charles M *BS in CE CE* '14 *MCE* '15 JASCE 406 E Market St Stockton Calif
Weber, Richard ....*CE* '18........................Camillus N Y
Transitman N Y State Ry 267 State St Rochester N Y
Webster, Adrian K ....*CE* '14 JMWeSE 5548 Blackstone Ave Chicago Ill
Ranch & Oil Business Box 3 Vega Texas
Weed, Addison ....*CE* '79......M N Y S Hor S North Rose N Y
Fruit Grower and Farmer
Weidberg, Naphtah ....*CE* '19..MAAE 1483 Bryant Ave New York City
*Weidman, J Hynds ....*CE* '03................AMASCE Syracuse N Y
Engineer and Contractor 209 Union Bldg
Weidner, Carl R ....*CE* '04 AMASCE 306 W Main St Independence
Chief Engineer The Prairie Pipe Line Co [Kan
*Weindling, Ludwig ....*CE* '18............719 Macon St Brooklyn N Y
Efficiency Engineer Columbian Rope Co Auburn N Y
*Weiss, Bertrand ....*CE* '09..........238 W 106th St New York City
Exporter & Importer 100 Fifth Ave
*Weiss, Charles................*CE* '13 MPghRyCl 247 Gregory Ave Passaic N J
Assistant Supervisor Pa R R Dunkirk N Y
Weiss, Samuel ....*CE* '13............1158 Carter Ave Detroit Mich
Salesman Semet-Solvay Co 1705 Real Est Exch Bldg
Welker, Philip A ....*CE* '78 ....MNGeoS MWaSE The Parkwood
Hydrog & Geod Engr in Chg Office U S C & G S Washington D C
*Welles, Theodore L Jr ....*CE* '13........JASCE 385 River St Kingston Pa
Constr Supt Crowell & Little Constr Co 1931 E 57th St Cleveland O
*Wells, Edward H Jr ....*CE* '10............743 Myrtle Ave Albany N Y
58 Sterling Place Brooklyn N Y
Wells, Jesse W...............*CE* '10 ....Setauket N Y
Surveyor
*Welsh, Russell D ....*CE* '13..AMASCE 721 Reservoir St Baltimore Md
Draftsman Western Pa Power Co Pittsburgh Pa
*Werner, Victor H ......*AB* '12 *CE* '14........182 Sunnyside Ave Brooklyn N Y
Sales Engineer Belmont Iron Works 15 Park Row New York City
West, Randolph C ....*CE* '20......1828 Calhoun St New Orleans La
West, Ray B ....*CE* '06........MOrSE MASAgrE 93 Boulevard
Director Agricultural Engineering & Mech Arts Utah Agr Coll [Logan Utah
*Whedbee, Edgar ....*CE* '10..........309 North St Portsmouth Va
Cons and City Engineer Bonham Tex

*Wheeler, Paul T .... *CE* '14 .... Lackawanna N Y
Leveler N Y State Highway Comm Canandaigua N Y
Wheelock, Charles B .... *CE* '76 .... 209 Babcock St Brookline Mass
Boston Manager Phoenix Ins Co of Conn 107 Water St Boston Mass
Whelpley, James R .... *CE* '96 .... Riverdale Md
Whipple, John B .... *CE* '07 .... AMASCE 209 Willow Ave Ithaca N Y
Engineer in Charge Construction Storm King Highway Newburgh N Y
Whiskeman, James P .... *CE* '98 .... AMASCE 2438 Devoe Terrace
Construction & Consulting Engineer 153 E 40th St New York City
Whitbeck, Arthur S .... *CE* '03 ...... MAAE MRoES 160 Rockingham St
Asst Engr Chg Constr Barge Canal & Harbor 43 Triangle Bldg Rochester N Y
White, Frank M .... *CE* '11 .... Brockport N Y
c/o Corrugated Bar Co 20 W Jackson St Chicago Illinois
White, John S .... *CE* '02 .... 103 Waban Ave Boston Mass
With Morse Chain Co of Ithaca N Y 141 Milk St
*White, Ralph L .... *CE* '11 ...... 1130 Academy St Watertown N Y
Wholesale and Retail Lumber & Contracting G W White & Son
*White, T Sidney .... *CE* '73 ...... MASCE MESWPa Beaver Falls Pa
Vice-President and Consulting Engineer Penn Bridge Co
White, Willard O .... *CE* '00 MASCE 150 Stockton Ave Uniontown Pa
Chief Engineer W J Rainey Fayette Title & Trust Bldg
*White, William A .... *CE* '12 .... 519 Park Ave Baltimore Md
*Whitman, Ezra B .... *CE* '01 .. MASCE 139 W Lanvale St Baltimore Md
Member Firm Norton Bird & Whitman Engrs 616 Munsey Bldg
Whitney, Andrew J 3d .... *CE* '18 .... 82 Linwood Ave Buffalo N Y
Rodman Classified Service Penn R R
*Whitney, Charles S .... *CE* '14 *MCE* '15 AMASCE 85 Pearl St Bradford Pa
Chief Engineer A C Eschweiler 720 Goldsmith Bldg Milwaukee Wis
Whitney, Guy F .... *CE* '14 .... New Hartford Conn
Secretary Nashua Employers Assn 85 Main St Nashua N H
Whitney, Leonard H M .... *CE* '08 .... 237 Grand St Hornell N Y
Whitney, Stanley E .... *CE* '13 .... 510 E Water St Elmira N Y
Junior Assistant Engineer N Y State Engr Dept
Whitney, William N .... *CE* '14 .... Holley N Y
With Roch Railway & Light Co Rochester N Y
*Whitson, Abraham U .... *CE* 99 .... AMASCE 307 State St Flushing N Y
City Surveyor
*Whittier, Paul F .... *BS in CE* *CE* '16 .... MAAE Chattahooche Ga
Resident Engineer Lockwood Greene & Co of Boston Mass Atlanta Ga
*Wich, Bernard .... *CE* '10. AMASCE 115 Kenmore Rd Brooklyn N Y
Section Engineer N Y State Public Service Comm 1st Dist
*Wick, Richard B .... *CE* '81 .... 125 No Vine St Warren O
Vice President & Engineer The Miller Construction Co Punxsutawney Pa
*Wieghardt, George F .... *CE* '09 .... MESP MAWWA 3210 Walbrook Ave
[Baltimore Md
*Wight, Frank C .... *CE* '04 .... 32 Waldron Ave Summit N J
Associate Editor *Engrg News-Record* Hill Bldg New York City
*Wigley, Chester G .... *CE* '07 AMASCE MAWWA 66 Piersiu Ave Maple-
Engineer with Clyde Potts 30 Church St New York City [wood N J
*Wigton, C Benson .... *CE* '09 .. AMASCE MASTM 1353 Watchung Ave
Mgr Contr Dept Levering & Garrigues Co 552 W 23d St N Y C [Plainfield N J

Wilcox, Clark L .... *CE* '01. . AMASCE MESWPa 329 So Atlantic Ave
Treasurer The Pitt Construction Co Inc Pittsburgh Pa
*Wilcox, Robert B .... *CE* '90..........................
*Wilgus, Herbert S .... *CE* '01.......... MASCE MAREA Angelica N Y
Consulting Engineer
Willcox, James DeWitt .... *CE* '07....... 1006 Crescent Ave Birmingham Ala
Assistant Manager Mutual Life Ins Co of N Y 629 Brown-Marx Bldg
*Williams, Alan F .... *CE* '15.... JASCE 35 Elm Ave Longbeach Calif
Williams, Chauncey G .... *CE* '87 MASCE 120 Crescent Ave Plainfield N J
209 E Seventh St
Williams, Edwin C............ *CE* '07...... 1348 Euclid St N W Washington D C
Assistant Accountant Standard Oil Co of N Y Shanghai China
Williams, Enrique Ruiz........ *CE* '06...... AMASCE MCuSE Contreras 70
General Manager Ca Servicios Publicos P O Box 25 Matanzas Cuba
*Williams, Friend P .... *CE* '99 MASCE MRoES 27 Barrington St Roches-
Special Deputy State Engineer Barge Canal Off Albany N Y [ter N Y
*Williams, Harold H .... *CE* '09........ 42 Herman St Glen Ridge N J
Sales Engineer David Lupton's Sons, Co 50 Church St New York City
*Williams, Howard S .... *CE* '02..........................
*Williams, J Stewart .... *CE* '08............ 205 Pierce St Kingston Pa
Engineer Spring Brook Water Supply Co Wilkes-Barre Pa
*Williams, Roger B Jr .... *CE* '01.................. AMASCE Ithaca N Y
With National City Co New York City
Williams, Sylvester N...... *CE* '72 *AM*. . MAREA 734 Fair Oaks Ave Oak Park Ill
Prof Emer of Civil & San Engrg Cornell College Mt Vernon Ia
Williams, Tudor R .... *CE* '03............ 1322 Gibson St Scranton Pa
Engineer La Bar-Williams Co 528 Scranton Life Bldg
Wilson, Calvin L .... *BS CE* '12...... 1222 Jennings Ave Ft Worth Tex
Auditor Acme Brick Co
*Wilson, Edgar M .... *CE* '10 The Alexandra 42d & Chester Ave Philadel-
[phia Pa
*Wilson, George E .... *CE* '12............ 416 South St Springfield Mo
President Springfield Wall Paper & Paint Co
Wilson, Harry K .... *CE* '08 AMASCE 1912 E Taylor St Bloomington Ill
Assistant Engineer B H Davis Cons Engr Whitehall Bldg New York City
Wilson, Percy S .... *CE* '18 *MCE* '20 .... 28 Woodlawn Ave Glen Ridge N J
*Wilson, W Edward............ *CE* '01.................. MASCE Seattle Wash
Consulting Engineer 3223 33d Ave So
*Windsor, Philip B .... *CE* '00.......... MASCE Pina Camagüey Cuba
*Wing, Charles B .... *CE* '86 ...... MASCE MASTM 345 Lincoln Ave
Professor of Structural Engineering Stanford Univ Palo Alto Calif
*Wing, Frederick K .... *CE* '90........ AMASCE MEClBu 592 Ferry St
Pres and Chief Engr F K Wing Co 1314 Prudential Bldg Buffalo N Y
Winship, Arthur W .... *CE* '19.............. 80 Broad St Plattsburg N Y
Winship, Lef .... *CE* '05 AMASCE MEClSL MAAE 4171 Cleveland
Assistant Chief Engineer Mo Pac R R St Louis Mo [Ave
*Wistrich, Harry .... *CE* '18........ 1106 Union Ave New York City
Bridge Dept LVRR So Bethlehem Pa
*Wolfe, Frank C............... *CE* '95............ MASCE Union Bridge Md
Engineer McLean Contracting Co 1412 Fidelity Bldg Scranton Pa
Wollenweber, Gay .... *CE* '11..........................

*Wong, Harold E ....*CE* '17 ...Kailan Mining Administration Tientsin
[China
Wong, Yik S ....*CE* '11.......5 Race Course Road Tientsin China
*Wood, Bertram L ....*CE* '11..........115 Reid Ave Brooklyn N Y
Wood, Edward A ....*CE* '08..AMASCE 2616 Maple Ave Dallas Tex
Resident Engineer Metropolitan Development Assn Chamber of Commerce
*Wood, Nelson T ....*CE* '16........316 Clifton Place Brooklyn N Y
American Telephone & Telegraph Co 195 Broadway New York City
Wood, Rollin D...............*CE* '06............338 W Decatur St Decatur Ill
Woodbury, Bicknell J ....*CE* '19...........432 Franklin St Danville Ill
406 Marquette Bldg Chicago Ill
Woodruff, Charles C Jr ....*CE* '20........148 12th St Long Island City N Y
*Woodruff, Glen B ....*CE* '10.................. AMASCE Wysox Pa
Assistant to Bridge Engineer LVRR Bethlehem Pa
*Works, Norris M ....*CE* '97..........748 Cramer St Milwaukee Wis
Superintendent 12th Lighthouse Dist 424 Federal Bldg
Wright, Chilton A ....*CE* '19 *MCE* '20 22 Kress Park New Rochelle N Y
*Wright, George C ....*CE* '03... MRoES 1609 Culver Rd Rochester N Y
County Assistant Engineer
*Wright, Harold B ....*CE* '14..............5 Jewett Place Utica N Y
Wright, Howard B ....*CE* '15..........126 Mildred Ave Syracuse N Y
Assistant to Estimating Engineer Semet Solvay Co
Wright, Thomas T ....*BA CE* '07..................AMASCE Warsaw Va
Henrico Lumber Co
*Wyckoff, Maurice M ....*CE* '12....AMASCE 246 Rochester Ave Brooklyn
Gen Pur Agt T A Gillespie Co and Allied Cos 50 Church St NYC [N Y
Wyckoff, Ralph F ....*CE* '08............1946 Ivar St Hollywood Calif
Mem Firm Rooney-Wyckoff Co Paving Contrs 607 So Hill St Los Angeles Calif
Yeh, Chia T ....*MCE* '20 MChES 3113 Kiangse Rd Shanghai China
Yen, Hoong-Kwie ....*MCE* '19 MSSCH MESCh East St Han-Shan Shien
Rodman P & R Ry Reading Pa [Anhui China
Yewell, J Edward.............*CE* '12 MAREA 140 Clinton St Greenville Pa
Chief Draftsman B & L E R R
*Young, Henry A ....*CE* '99..MASCE 10 Myrtle Ave Maplewood N J
Manager Young & Hyde Inc Contrs Prod Exch Bldg New York City
Young, Nathan E ....*CE* '01..........123 W Main St Union N Y
Road Contractor Jeffersonville N Y
Yzaguirre, Salvador M ....*CE* '10..............MCuSE Camagüey Cuba
District Engineer Cuba Cane Sugar Corp Central Stewart
Zabel, Oscar E F ....*CE* '15 ....MAAE MRoES 640 Magee Ave
Inspector on Constr Engineering Dept Eastman Kodak Co Rochester N Y
Zabel, William J ....*CE* '14..MRoES 118 Clifford Ave Rochester N Y
Assistant Engineer N Y S Barge Canal Off
*Zagoren, Lewis I..............*CE* '14....138 No McDowell St Charlotte N C
Assistant Engineer Southern Engineering Co
*Zambrana, José A ....*CE* '15.....................Juana Diaz P R
C/o Municipio San Júan P R
Zander, Roy J................*CE* '17..........2014 Sheffield Ave Chicago Ill
Member Firm Zander-Reum Co 105 W Monroe St
Zarbell, Elmer................*CE* '95...MASCE 2089 Sherwood Ave Louisville
Assistant to Chief Engineer L & N R R CO [Ky

Zee, Nai-Zung ....*MCE* '19 MSSCh MESCh 331 Peking Rd Shanghai [China

*Zieget, Julius ....*CE* '10....4208 Springdale Ave Baltimore Md
Secretary & Assistant Treasurer S K F Ind Inc 165 Broadway N Y C

Zolzer, Charles H.... ....*CE* '01...........9 Whitter St E Orange N J
Engr and Sales Mgr Electro-Chem Sup & Eng Co Philadelphia Pa

IN MEMORIAM

FREDERICK JAY KNIGHT, C.E., 1873

DIED AT WASHINGTON, D. C., ON MAY 9, 1920

Frederick Jay Knight died in Washington, D. C., on the ninth of May.

He was born in Monroe, N. Y., on March 11, 1853, and was the son of Chauncey B. and Mary Thompson Knight. He entered Cornell in 1869 and graduated with the degree of B.C.E. in 1873. He was a member of Delta Kappa Epsilon and roomed with Edwin Gillette, the present secretary of the class. He rowed in the second varsity four-oared shell and stroked his second class four. He was a member of the Philidor Chess Club.

For some years after graduation he was engaged with Major T. Benton Brooks, completing among other things a mineralogical survey of Michigan. He was connected with the U. S. Geological Survey for some time, making surveys of Kentucky, West Virginia and other states. He spent some two years on an irrigation project in Arizona. Then he returned to his native county, being in business in Goshen for some years, and afterward returning to Monroe.

Among the notable projects which he carried on were the water systems of Montgomery and Monroe, and additions to the Warwick system; a topographical and water power survey of the Harriman estate; the inclined railway to the top of Harriman Mountain; the drainage of bottom lands in the Ramapo Valley between Harriman and Tuxedo; boundary surveys of Harriman and Harriman State Park, and preliminary surveys for the location of Bear Mountain Inn for the Palisades Interstate Park Commission. At the time of his death he was in Washington connected with the International Boundary Commission, engaged on the boundary between Canada and the United States.

He is survived by his wife, who was Mrs. Emma Irene Patterson and whom he married on August 11, 1891.

DR. AUGUSTUS VALENTINE SAPH, M.S., M.C.E., '01; Ph.D., '02

DIED AT BERKELEY, CALIF., FEBRUARY 13, 1920

Dr. Augustus Valentine Saph, who was graduated from Cornell University with the M.C.E. degree in 1901 and the Ph.D. degree in 1902, died from influenza at his home, 2330 Durant Ave., Berkeley, Calif., on February 13, 1920.

Before entering Cornell, Dr. Saph received the degrees of C.E. and M.S. at the University of California, where he returned as instructor in drawing in 1902. After five years of teaching, he went into active work as a structural engineer. He followed this line of work until 1914, when he began his private practice as consulting engineer, specializing on steel and concrete. One of his most notable accomplishments was the design of the water tower for the Calaveras Dam.

FRANCIS W. H. CLAY, C.E., CLASS OF 1893

DIED AT WASHINGTON, D. C., MAY 10, 1919

Francis Warfield Herrick Clay died of pneumonia at Washington, D. C., on May 10, 1919.

Mr. Clay was born at White Hall, Ky., on February 9, 1869, the son of Col. John F. Herrick Clay and Mary Barr Clay. After spending two years at the University of Michigan, in 1890 he entered Cornell and received the degree of C.E., in 1893. He was a member of Psi Upsilon, Undine, Bench and Board, Mermaid, the Southern Club, the Masque, the History and Political Science Association, the Woodford Debating Society, and the Civil Enginereing Society, and in his senior year was prominent in light-weight sparring. After leaving Cornell, he attended law classes in Columbia University, graduating LL.B. in 1896.

He practiced law for several years until 1916, when he was appointed Assistant Commissioner of Patents in the Department of the Interior at Washington, holding this position until the time of his death. He was married on October 12, 1905, to Miss Jane Swigert Watson, who survives him with five children, three sons and two daughters.

LOUISE A. HAMMEL, WIFE OF VICTOR F. HAMMEL, C.E. '07

DIED AT BOSTON, MASS., FEBRUARY 16, 1920

Mrs. Louise A. Hammel of 35 Maple Court, Flatbush, Brooklyn, N.Y., passed away at the Phillips House, Massachusetts General House, Boston, on February 16, 1920, following an emergency operation on February 12th. She was buried on February 19th at Joliet, Illinois.

She is survived by her husband, Victor F., and daughter, Georgia. Mr. Hammel's class is C. E. '07.

DECEASED MEMBERS

Name	Residence	Date of Death
Allen, Charles F	*CE* '73 Denver Colo	Feb 7 1914
Almeida, M B	*CE* '09 Bello Horizonte Brazil	Oct 6 1916
Ames, Willis C	*CE* '77 Whitney's Point N Y	Feb 23 1894
Aylen, Charles P	*CE* '76 Aylmer Canada	April 1894
Aylen, John	*CE* '77 Winnipeg Canada	Oct 19 1916
Baker, Howard W	*CE* '86 Minneapolis Minn	Dec 30 1919
Beakes, Charles C	*CE* '16 Sidney Center N Y	Oct 9 1918
Biersuck, Jacob	*CE* '13 Brooklyn N Y	Jan 15 1918
Bowman, Daniel W	*CE* '72 Miami Fla.	March 14 1917
Brauner, Julius F Jr	*CE* '05 Ithaca N Y	Sept 4 1918
Breedlove, John C	*CE* '02 St Paul Minn	March 10 1915
Brown, Allen J	*CE* '96 Oswego N Y	April 7 1903
Bueno, Francisco de A V	*CE* '76 Rio de Janeiro Brazil	About 1881
Burns, Justin A	*CE* '92 Watertown N Y	Nov 14 1905
Bush, John L	*CE* '08 Utica N Y	Oct 21 1916
Cabassa, Hermann	*CE* '11 Mayaguez P R	June 30 1911
Canaga, Ira D	*CE* '11 Charleston W Va	July 10 1913
Carpenter, Frank De Y	*CE* '73 *MCE* '76, Highland N Y	Dec 19 1883
Chapman, Carleton T	*CE* '00 Rochester N Y	Sept 26 1917
Chase, Arthur R *AB*	*CE* '05 Sioux City Ia	Dec 7 1905
Clark, Dan B	*CE* '93 Newtonville Mass	May 20 1904
Clark, Frank B	*CE* '96 Fulton N Y	Oct 29 1889
Clark, Ira E	*CE* '72 Weston Mass	May 23 1882
Clay, Francis W H	*CE* '93 *LLM* Washington D C	May 10 1919
Colburn, Dan K	*CE* '72 Woodhull Ill	June 3 1914
Conable, Morris R	*CE* '76 Monrovia Calif	Sept 15 1907
Cook, Charles F	*CE* '06 New York City	Jan 1 1919
Cook, Isaac N	*CE* '75 Jersey City N J	May 7 1885
Cooper, Edgar H	*CE* '85 New York City	Oct 1890
Cooper, Wilfred L Jr	*CE* '10 Bedford Pa	July 23 1911
Cornell, Oliver H P	*MCE* '74 Winston-Salem N C	Oct 13 1911
Couch, Vinton M	*CE* '91 Odessa N Y	Nov 4 1901
Crandall, Charles L *BCE*'72	*CE* '76 *MCE* '08 Ithaca N Y	Aug 25 1917
Curtis, Winthrop L	*CE* '92 Horseheads N Y	June 20 1913
Deane, Frank P	*CE* '08 Buffalo N Y	Feb 6 1918
Denham, Donald P	*CE* '14 Peterboro Ont Can	Oct 23 1918
Dewar, Robert C	*CE* '09 So Norwalk Conn	May 20 1914
Dickinson, Joseph A	*CE* '10 Pueblo Colo	May 28 1914
Dimon, Henry G	*CE* '87 New Rochelle N Y	Jan 9 1902
Dordaluboff, John A	*CE* '74 Nijni Novgorod Russia	About 1882
Dodd, Franklin M G	*CE* '90 Franklin N J	Sept 13 1891
Doerflinger, Augustus	*CE* '71 Brooklyn N Y	Nov 24 1899
Eidlitz, Alfred H	*CE* '76 New York City	April 22 1877
Emerson, Harry H	*CE* '13 Conneaut O	Feb 28 1916
Emmons, Charles M	*CE* '88 Beaver Falls Pa	Sept 14 1911
Enos, George W	*CE* '96 Chaumont N Y	Nov 3 1905
Ewing, William B	*CE* '83 La Grange Ill	April 18 1911

Name	Residence	Date of Death
Fanning, Winthrop C	*CE* '16 Whitestone N Y	March 10 1919
Farnham, Irving T	*CE* '92 West Newton Mass	Sept 19 1908
Farnham, Whitfield	*CE* '71 *MCE* '74 St Louis Mo	April 13 1895
Fay, Lawrence B	*CE* '06 Washington D C	Sept 17 1912
Ferguson, Nicholas C	*CE* '79 St Louis Mo	Sept 22 1896
Fisher, Bertrand A	*CE* '85 Sausalito Calif	May 27 1906
Fisher, Nathan S	*CE* '99 Norwich N Y	Aug 29 1900
Fitch, William R	*CE* '74 Ithaca N Y	April 14 1886
Foster, Reuben B	*CE* '74 *MCE* '77 S Lake Wier Fla	Nov 7 1895
Fraleigh, Herbert E	*CE* '02 Saranac Lake N Y	Nov 16 1917
Frost, Arthur B	*CE* '01 Ithaca N Y	March 7 1902
Frost, Frederick W	*CE* '72 New York City	Oct 3 1899
Gaston, Louis	*CE* '08 Havana Cuba	Nov 28 1908
Geigel, Antonio S	*CE* '92 San Juan P R	Jan 17 1901
Gibbs, Harley S	*CE* '98 Pittsburgh Pa	Aug 8 1899
Gilbert, Warner W	*CE* '95 Rochester N Y	May 19 1901
Gillette, Olin C	*CE* '71 Atlanta Ga	Jan 25 1901
Green, Rutger B	*CE* '95 Detroit Mich	Dec 8 1908
Green, Almon C	*CE* '75 Palmyra N Y	July 28 1897
Guinn, John B	*CE* '92 Joplin Mo	May 17 1905
Gunner, Daniel W	*CE* '87 Schagticoke N Y	Oct 10 1887
Haag, John M	*CE* '97 Windham O	Feb 7 1918
Halbert, Henry D	*CE* '85 San Diego Calif	Feb 26 1910
Hallock, E Allen	*CE* '91 Moriches N Y	April 13 1900
Hasbrouck, Alva D	*CE* '88 Highland N Y	July 5 1904
Hasbrouck, Charles A	*CE* '84 Pasadena Calif	Feb 1 1910
Herman, Robert	*CE* '79 Washington D C	Dec 9 1915
Hibbard, Horace N	*CE* '74 Ithaca N Y	Sept 18 1914
Higley, Anson H	*CE* '99 Syracuse N Y	Sept 22 1913
Himes, Albert J	*CE* '87 Cleveland O	Nov 3 1919
Hitz, Irving	*CE* '91 Chicago Ill	Sept 24 1901
Holbrook, Ernest M	*CE* '89 *MCE* '90 Ithaca N Y	Oct 9 1892
Holloway, Roger T	*CE* '08 Montclair N J	March 12 1914
Hulse, Howard C	*CE* '91 Brooklyn N Y	Feb 20 1893
Jacobs, J L	*CE* '04 New York City	Oct 2 1918
Jacobs, Julius L	*CE* '04 New York City	Oct 2 1918
Jordao, Elias F P	*CE* '74 Sao Paulo Brazil	March 25 1901
Kerr, James A	*CE* '13 New York City	June 28 1915
Key, Da Yong	*CE* '14 Nanking China	Jan 1917
Knight, Frederick J	*CE* '73 Washington D C	May 9 1920
Landers, Herbert H	*CE* '90 Green Island N Y	Feb 4 1893
Lattin, Benton	*CE* '07 Ashtabula O	May 2 1911
Law, Harry C	*CE* '08 Buffalo N Y	Oct 9 1912
Liu, Zoong D	*CE* '12 Hankow China	Oct 1914
Lyman, George F	*CE* '73 Tenafly N J	Dec 25 1880
McClure, Hunter	*CE* '10 Piedmont Calif	Sept 26 1918
McConnell, Jacob W	*CE* '13 Canton O	June 22 1913
McCormick, Cyrus H	*CE* '78 Riverton Wyo	April 17 1908
McCrea, Clark W	*CE* '81 *MCE* '84 Cape Girardeau Mo	Jan 23 1912
MacMullen, Justus C	*CE* '76 Unionville N Y	Jan 31 1888

Name	Residence	Date of Death
Makepeace, M D	*CE* '75 Syracuse N Y	July 14, 1916
Marrian, R R	*CE* '15 New York City	Oct 17 1918
Martinez, Christobal A	*CE* '07 Vera Cruz Mex	About Mar 1914
Merrill, Ogden	*CE* '99 New York City	Oct 5 1918
Mersereau, Charles V	*CE* '79 Los Angeles Calif.	Dec 6 1917
Moore, Clarence S	*CE* '98 Olean N Y	July 7 1900
Moore, Harold T	*CE* '13 Richmond Hill N Y	Dec 26 1914
Moore, Howard R	*CE* '13 Patchogue N Y	Oct 6 1918
Moraes, Domingo C de	*CE* '77 Sao Paulo Brazil	Dec 15 1917
Mossman, Harold A	*CE* '14 Buffalo N Y	April 25 1918
Neeley, Samuel T.	*CE* '85 Cape Girardeau Mo	Aug 6 1918
Northrup, Henry G.	*CE* '74 Brooklyn N Y	Oct 14 1919
Oettinger, David	*CE* '14 Washington D C	Oct 7 1918
Page, John.	*CE* '80 Oil City Pa	June 27 1910
Park, Robert B.	*CE* '94 Athens Pa	Aug 24 1905
Parke, Robert A	*CE* '80 Pittsburgh Pa	
Parsons, Frank	*CE* '73 Boston, Mass	Sept 26 1908
Peck, William T	*CE* '02 Bristol, Conn	Sept 12 1905
Perkins, Philip H	*CE* '75 Superior Wis.	Sept 23 1918
Perkins, Ralph W	*CE* '14 Springfield Mass	Oct 31 1916
Pierce, Henry	*CE* '80 Richmond Va	Aug 21 1911
Pitzman, Harold W	*CE* '06 St Louis Mo	Nov 21 1906
Potter, Fred H jr	*CE* '94 New York City	Jan 7 1916
Pratt Winslow S	*CE* '04 Albion N Y	Aug 18 1908
Preston, Edward L	*CE* '79 Ellenburg Wash	Oct 14 1906
Preston, Erasmus D	*CE* '75 *MCE* '80 Washington D C	May 8 1906
Preston, Kolce	*CE* '73 Wilmington Del	Jan 4 1876
Price, Charles S	*CE* '72 Johnstown Pa	Jan 10 1915
Puffer, L R	*CE* '14 Hartford Conn	March 21 1918
Rawson, Forrest H	*CE* '10 Glens Falls N Y	Nov 21 1912
Redmond, Hugh	*CE* '03 Camillus N Y	Oct 24 1911
Rogers, Jesse A.	*CE* '91 Evans Mills N Y	April 24 1897
Rommel, Arthur E	*CE* '02 Oskaloosa Ia	Feb 26 1916
Salmon, Samuel W	*CE* '71 Mt Olive N J	Aug 7 1910
Saph, Augustus V	*MSM CE* '01 *PhD* '02 Berkeley Calif	Feb 13 1920
Schlegel, Raymond	*CE* '11 Baltimore Md	Oct 6 1918
Seabury, Albert H	*CE* '95 Hempstead N Y	Sept 13 1915
Seelye, Edward E.	*CE* '08 St George N Y	Nov 8 1912
Seidell, William C	*CE* '04 Peterboro N Y	Dec 28 1904
Shaler, Ira A	*CE* '84 *MCE* '86 New York City	June 29 1902
Sheldon, Daniel C	*CE* '83 Delphi N Y	Oct 2 1893
Shepard, Frank W	*CE* '86 Medina O	Feb 10 1892
Sherman, Frederick E	*CE* '07 Watkins N Y	March 8 1909
Shuttleworth, Frederick J.	*CE* '10 Albany N Y	April 13 1911
Sill, Cyrus B	*CE* '72 Edinboro Pa	Sept 30 1908
Sill, John M	*CE* '11 Detroit Mich	Jan 22 1919
Simpson, George F	*CE* '79 New York City	April 23 1915
Smith, George LaT	*CE* '71 *MCE* '74 Canandaigua N Y	June 25 1892
Smith, William J	*CE* '79 Charleston N Y	Dec 3 1886
Spafford, James H	*CE* '17 Baltimore Md	Oct 9 1918

Name	Residence	Date of Death
Spielman, Charles	*CE* '15 Brooklyn N Y	Oct 11 1918
Stewart, Neil Jr	*CE* '87 York N Y	March 30 1891
Stolp, Myron G	*CE* '72 New York City	Mar 5 1906
Storey, Frank B	*CE* '10 Rochester N Y	April 21 1915
Sugi, Bungo	*CE* '90 Tokio Japan	Fall of 1913
Tatnall, George	*CE* '75 Wilmington Del	Sept 13 1906
Terhune, E Stanley	*CE* '09 Newark N J	Nov 8 1918
Tibbetts, Addison S	*CE* '77 Lincoln Neb	Sept 25 1915
Tiley, George	*CE* '73 Washington D C	March 14 1877
Tompkins, John H	*CE* '73 Poughkeepsie N Y	July 1897
Toms, Jay W	*CE* '09 Frederick Md	Dec 20 1918
Tracy, Walter H	*CE* '05 Albuquerque N M	May 1819
Turner, Kenneth B	*CE* '03 *MCE* '05 Ithaca N Y	Oct 21 1918
Van Cauteren, Emile A	*CE* '97 Pringy Seine-et-Marne France	July 4 1898
Viegas-Muniz, Joaquin	*CE* '77 Pirocicaba Brazil	About 1883
Watson, George B	*CE* '12 Grandmere Quebec Can	June 27 1915
Whitlock, Edgar M	*CE* '10 San Francisco Calif	Sept 26 1918
Wightman, Willard H	*CE* '81 Ashland Ore	Oct 29 1889
Wolkowski. Alex I	*CE* '07 Suwalki Russia.	Sept 27 1910

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